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August 9, 1993

**BY FEDERAL EXPRESS**

Cynthia L. Hutchison  
United States Environmental Protection Agency  
Region VII  
726 Minnesota Avenue  
Kansas City, KS 66101

RE: Steelcote Facility - St. Louis, Missouri  
Docket No. VII-91-H-0025

Dear Ms. Hutchison:

Enclosed are two copies of the "Results of Cone Penetrometer Tests and Reverse Slug Tests" for the above-referenced facility.

Please let me know if you have any questions.

Very truly yours,

*Alphonse McMahon*

Alphonse McMahon

AM/bp  
Enclosures

cc: Douglas A. Niedt (w/ encl.)  
Greg Niedt (w/ encl.)  
Donald McQueen (w/o encl.)

STL-125254.1

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**RESULTS OF CONE PENETROMETER  
TESTS AND REVERSE SLUG TESTS  
STEELCOTE FACILITY  
ST. LOUIS, MISSOURI**

**RECEIVED  
AUG 10 1993  
RCOM SECTION**



**SHANNON & WILSON, INC.**  
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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## **1.0 INTRODUCTION**

### **1.1 Purpose and Content**

This report is being submitted by Niedt Realty Company and Niedt Enterprises, Inc. f/k/a Steelcote Manufacturing Company ("Steelcote") to the United States Environmental Protection Agency, Region VII ("USEPA"), pursuant to an Administrative Order on Consent, Docket No. VII-91-H-0025 ("AOC"). The purpose of this report is to present the information developed during the field work described in Addendum #2 to the Plan of Study to characterize the former Steelcote facility (the "site") as required by Paragraph 26 of the AOC.

This report contains a description of the site, its location and history of land use, a description of the hazardous waste concerns, a presentation of previously existing and relevant information, and data generated during this phase of the investigation. This includes data interpretation, conclusions, and recommendations. Attached to this report are appendices containing field notes, cone penetrometer test (CPT) results, and reverse slug test results.

### **1.2 Facility and Operations Description and History**

The site is located along the south side of Mill Creek Valley and bounded by several streets including Gratiot, Steelcote Square, and Papin and the Missouri Pacific Railroad Right of Way. The site location is indicated in the map provided in Figure 1 and the layout of the site with test locations is shown in Figure 2. Figure 3 is an aerial photograph which presents the site and the surrounding area. As is readily apparent, the site is surrounded by property used for rail truck transport, material storage, commercial and industrial purposes.

Site development for current operations began in the early 1920's. In 1926, construction started on the varnish plant at the corner of Gratiot and Edwin Streets (now known as Steelcote Square). Buildings were constructed to house varnish cookers, a boiler, storage tanks for raw materials and finished varnish, varnish reducing tanks and an office. The products made were varnishes based on naturally occurring products, including tung, linseed, and soya oils. Later, Steelcote installed a small 500-gallon reactor to manufacture alkyd resins for in-house use. This building suffered a fire in the reactor in about 1970, and production was stopped at that time.

Z-301-01 STEELCOTE FACILITY



NORTH



SOURCE: U.S.G.S. 7.5 min. QUADRANGLES  
GRANITE CITY AND CAHOKIA, DATED 1954

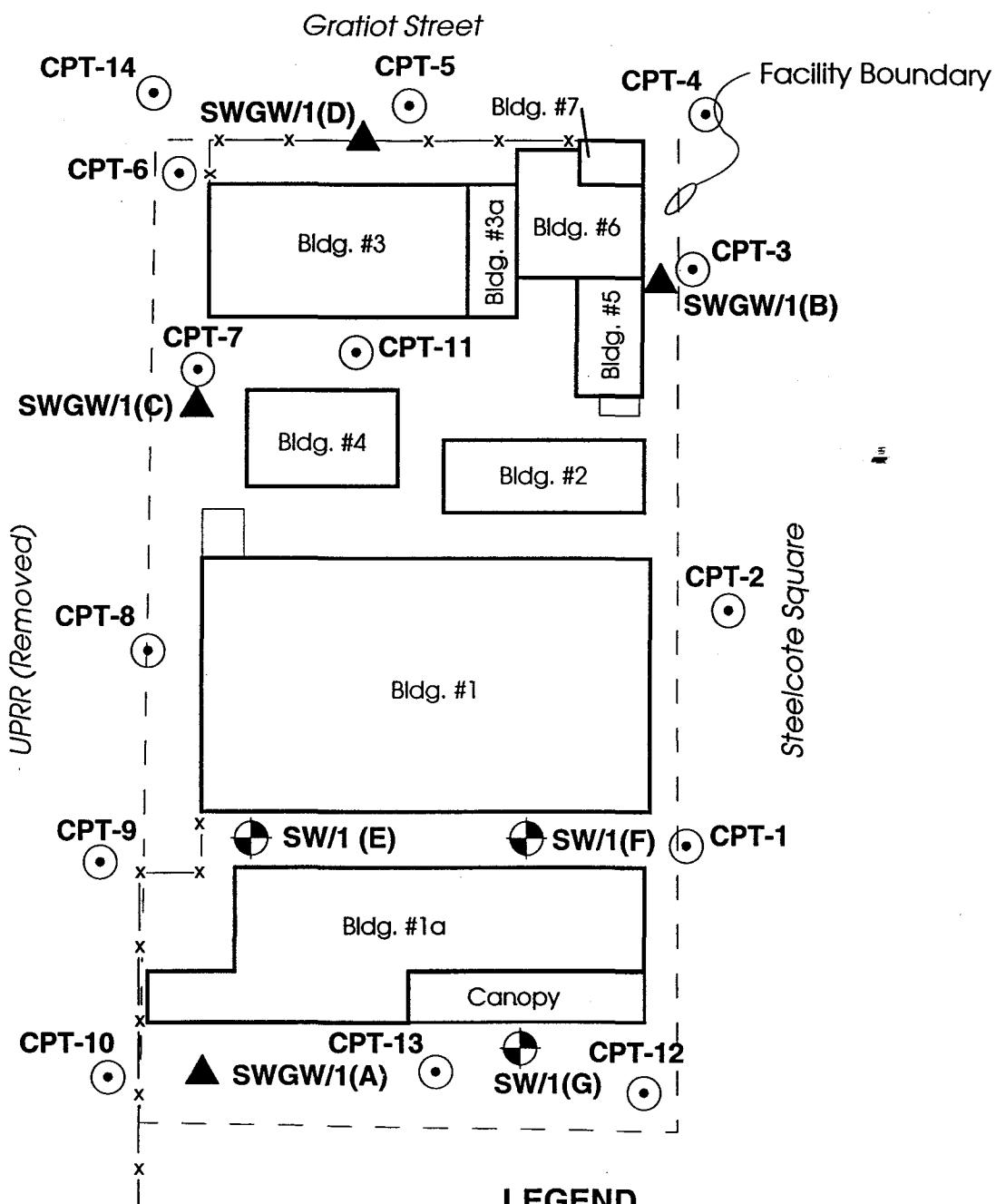
SCALE: 1"=2000'

SITE LOCATION



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FIGURE 1



#### LEGEND



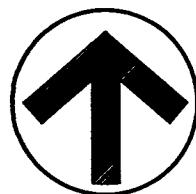
Approx. Boring Location



Approx. Ground Water Monitoring Well Location



Approx. CPT location



NORTH

0 20 40 80  
Scale, in feet

SITE LAYOUT AND TEST LOCATIONS  
STEELCOTE FACILITY  
ST. LOUIS, MISSOURI



NORTH



1. NATIONAL ENGINE
2. AMERICAN ENGINE
3. CAN MAN
4. WILKES DIRECT MAIL
5. WILKES PRINTING
6. COMMERCIAL MOBILE CLEANING
7. TECH MFG., INC.
8. VACANT
9. CORRIGAN COMPANY
10. SIMCO
11. JULIUS SEIDEL & CO.
12. WILKES PRINTING

SOURCE: SURDEX, INC. 1991

SCALE: 1"=200'

AERIAL PHOTOGRAPH



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Geotechnical Consultants

FIGURE 3

In 1926, construction started on the first part of Steelcote's factory at One Steelcote Square, immediately south of the varnish plant. The first phase included three floors and a basement. In 1934, two more floors were added to give the plant its present configuration.

In the 1960's, the property south (steel shed) of the Steelcote plant was purchased. Steelcote used the storage shed and the north portion of the courtyard south of the storage shed for packaged raw materials. Empty drums were stored outside the shed prior to pick-up for return or recycling.

Also, two Missouri Pacific Railroad spurs ran through the property. One ran along the east side of the warehouse and was never used by Steelcote, but was used by Grocers Warehouse Building, south of the Steelcote warehouse, for incoming food products, and was subsequently used by other owners. These tracks were all removed in 1989-1990 by Union Pacific Railroad, which bought out Missouri Pacific Railroad. The other spur ran just west of the varnish plant and main factory. A section of this line was used by Steelcote to off-load tank cars of solvents and vegetable oils, e.g. linseed, soya, and tung, to the on-site storage tanks.

Steelcote started at its present site by making asphalt roof coatings, putties, caulk, and enamels from natural raw materials. In 1926, Steelcote started using natural rubber in its enamels as a plasticizer. In 1938, Damp-Tex Enamel was introduced as a wet surface, mold and mildew resistant enamel.

In the 1950's, plastic resins became available and Steelcote started to use vinyl latex, polyamide epoxies, and polysulfide sealants. In the 1960's and 1970's, Steelcote utilized 100 percent solids type epoxy mastics, moisture cured urethanes, two part polyurethanes, polyamide water-borne epoxies, 100 percent solids flooring compounds, and 100 percent solids, low temperature epoxies.

In recent years, until Steelcote ceased manufacturing operations in March 1992, Steelcote manufactured a wide range of Low VOC and water-borne epoxies, (to comply with more recently established air emission standards set by other states), alkyd based wet surface enamels, single component (moisture-cured) and two-part polyurethanes, polysulfide sealants, 100 percent solids epoxy linings for tanks and containment areas, and 100 percent solids epoxy flooring compounds.

The site currently is almost completely covered with buildings and/or pavement. In addition the site is underlain by various utilities, both currently in operation and abandoned. As is indicated on the layout, approximately eighty percent of the site is occupied either by buildings or concrete paving.

As previously mentioned, and as is reflected in Figure 3, the area surrounding the Steelcote facility is highly industrialized. In fact, the Mill Creek Valley was one of the first areas industrialized within St. Louis and has a history of industrial development which predates the Civil War. The Steelcote site, prior to the establishment of the company, has been occupied by a number of operations, including a railroad line and a stock yard.

The development of Mill Creek Valley has included establishment of railroad lines parallel to the creek and the creek has been realigned as necessary to accommodate industrial development. At the present time, site drainage is accomplished by storm sewers which are located beneath and adjacent to the railroad lines and by ditches which parallel the railroad lines. The area has been subject to grading and placement fill. Fill placed at Mill Creek includes materials of industrial origin, including power plant ash, demolition debris and waste products.

### 1.3 Investigations Conducted To Date

Steelcote notified EPA that it generated hazardous wastes and was assigned an EPA Identification Number for the facility. In 1989 and 1991, EPA conducted Compliance Evaluation Inspections (CEI) at the site. Based on these inspections, EPA concluded that hazardous waste is present or has been released from the facility and that Steelcote was required to investigate the nature and extent of any hazards that may be present. No other inspections or investigations had been conducted.

The first phase of site investigation was conducted in April, 1992, in accordance with the Plan of Study (POS) to characterize the site as required by Paragraph 26 of the AOC. Anomalous ground water conditions were identified following the placement of ground water monitoring wells at the site. The use of the cone penetrometer and reverse slug testing described in this report were suggested as a means to investigate the anomalous conditions. Work to date has been accomplished in accordance with the POS and subsequent addenda and is limited to the

initial subsurface investigation, first though fifth round of quarterly ground water sampling, and the investigation of the anomalous ground water conditions described in this report.

Development of the final site characterization report required under the AOC has been deferred pending the results of the additional studies.

## 2.0 DATA COLLECTED

### 2.1 Cone Penetrometer Testing

Cone penetrometer testing was conducted June 14-16, 1993, at the site at the locations shown in Figure 2. A total of 14 locations were tested. Two of the proposed locations on the north and south perimeter of Building #1 were not tested due to inaccessibility. CPT work was conducted using a truck-mounted rig for pushing the rods and instrumented probe into the subsurface and connected to the portable field computer for data collection. The testing was done in accordance with Technical Procedure #10 presented in Addendum #2 to the POS.

Typically, a boring was drilled with solid flight augers to a depth of 1 to 7 feet depending on the amount of fill present which would interfere with pushing the probe. The augers were removed and the borehole backfilled with clean sand before placing the probe in position for each test. The probe was pushed to the depth at which refusal was encountered.

The data were observed during the investigation on a portable computer with software written by Hogentogler & Co., Inc., for collection of field cone penetrometer data. The data were written to and saved on a bubble cassette in the Hogentogler datalogger connected to the portable computer. The data were subsequently downloaded to a computer at Shannon & Wilson's office for processing and interpretation. Parameters recorded during each test included depth, tip resistance, sleeve resistance or local friction, pore pressure, probe inclination, and temperature during the pushing of the probe. Once the probe had reached refusal, pore pressure dilation was recorded until the pore pressure had equilibrated and testing ended at that location.

The rods and probe were pulled from the boring and decontaminated prior to testing at the next location. The boring was plugged using a cement-bentonite grout which was placed via a tremie pipe from a portable grout plant.

## **2.2 Reverse Slug Testing**

Reverse slug tests were conducted on each of the four wells at the site to see if the anomalous ground water conditions observed were caused by improperly constructed/developed wells. The tests were conducted in accordance with the protocol presented in Technical Procedure #9 in Addendum #2 to the POS and results of the tests indicate that the wells were functioning properly.

Prior to adding water to the well, the water level in the well was measured and recorded. Calculations for the amount of water needed were based on this measurement and included the annular space. Distilled water obtained from Absopure, Inc. was added to the well until the water was approximately within one foot of the top of the well screen. The water added did not reach a stabilized level prior to recording the fall in the water level because the well and formation were already responding to the head of water placed above its equilibrium level.

The water levels were read using a clean electric tape and recorded at frequent intervals initially (typically every 5 or 10 seconds) until the rate of fall diminished. The time between readings was expanded as the rate slowed over the duration of the test. Data collection continued until the water level had dropped to at least 25% of the distance from the start of the test to the original water level. For each well, the tests were continued until the well had recovered at least 70% of its original water level.

## **3.0 DATA INTERPRETATION**

### **3.1 Cone Penetrometer Tests**

The data generated during the cone penetrometer testing were processed with a computer program written at the University of British Columbia, Vancouver, British Columbia. It is an interactive program which is compatible with the data format of the Hogentogler & Company field computer systems. The program reduces and formats the raw data which aids in the interpretation of the soil behavior, equivalent relative density, angle of internal friction, equivalent SPT N value, corrected SPT N1 value, cyclic stress ratio, and undrained shear strength. These data are presented in Appendix B as Tables B1-B14 and Figures B1-B14. Such data aid in the interpretation of site hydrology and geology and includes the graphical presentation of the tip resistance, local friction, and pore pressure, and the interpreted CPT

profile. It also permits determination of apparent bedrock and development of a ground water contour map generated using the pore pressure dissipation data.

In general, the CPT data indicate silty clay and clay to be present to depths of 30-35 feet. Below 35 feet there is variation, however the overall trend is for the soil to be more silty and locally trace to slightly sandy. At about 40 feet and extending to about 45 feet, the soil is predominantly sandy silt and silty sand in the northern portions of the site. The southern portion of the site at this depth interval appears to be more clayey silt to silty clay with trace sand. Note that this interval appears to be the primary water-transmitting strata at the site. Below 45 feet, the data indicates variation from sandy silt to silty clay and clayey silt.

The apparent depth to bedrock, based upon resistance to further penetration by the probe, varied from approximately 57 to 60 feet below the ground surface. A contour map of the apparent depth to bedrock at the site is presented in Figure 4. The consistent depth to bedrock indicates no karst features at the top of bedrock. In addition, no man-made structures were encountered at depth during the CPT investigation. Generalized geologic cross sections are shown in Figures 5 and 6. Note that the boundaries depicted for the different soil types are gradational and that the soil type shown represents the soil type which predominates in that interval. The soil behavior types identified with the CPT work is consistent with the information generated during the Spring 1992 drilling and sampling program. The CPT work indicates the presence of isolated and possibly perched water, as discussed further below in this section.

The pore pressure data provided an interpretation of the water level for the ground water across the site. The data did not indicate water to be restricted to a particular soil type and there was a high degree of variability in the ground water elevations. Nevertheless, the lithology of the site indicates that water is most readily transmitted in the sandy layer which occurs at 40 to 45 feet below the surface.

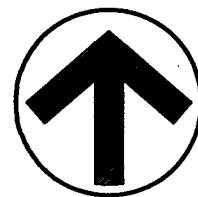
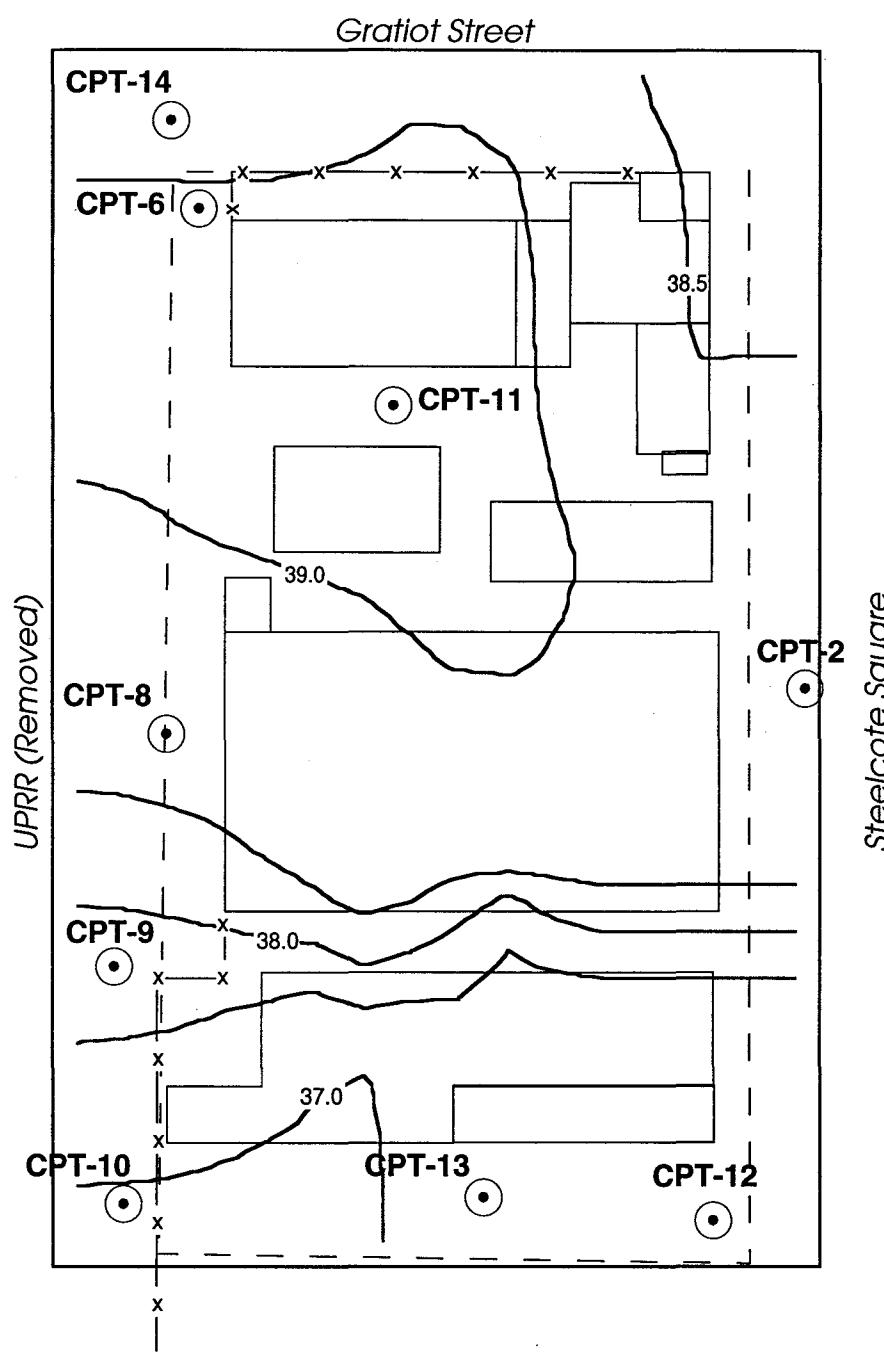
Water levels expressed as depth below ground surface varied between approximately 24 to 47 feet. A ground water contour map is presented in Figure 7. The data indicated water levels which were consistent with those measured previously and currently in the existing monitoring wells and a contoured plot of the ground water elevations did indicate a consistent picture of the apparent ground water flow pattern at the site (Figure 7).

The plot indicates ground water highs at the northwest and southeast ends of the site and ground water lows at the northeast and southwest areas of the site. It appears there are ground water "valleys" trending approximately northeast and southwest. The apparent direction of ground water flow is complex with indications that a ground water divide is present trending northwest-southeast. It suggests that water in the northeast portion of the site flows southerly or easterly and eventually toward the northeast off the site and that ground water in the southeast portion of the site flows north. Ground water in the northwest portion of the site appears to flow south and east and ultimately flows to the west off the site. In the far northwest corner, flow appears to include a northerly component. Ground water in the southwest portion of the site appears to flow north to northwest and ultimately flows to the the west off the site. These conditions may also be, in part, the result of surface and subsurface structures. Nevertheless, the general pattern of ground water flow appears to be consistent with the apparent ground water flow direction determined by the monitoring wells.

The pore pressure data from CPT locations 6 and 14, which are within 20 feet of each other, indicated water levels of approximately 24 feet and 36 feet from the ground surface. Note also that the water levels determined in CPT locations 11 and 14 are also consistent with each other. This difference in water level in such a short distance suggests that at least two different water bearing zones are present, with the different level possibly representing either an isolated or perched ground water condition.

### 3.2 Reverse Slug Tests

The data generated during the field testing included time and associated water depth. These data were entered into a spreadsheet program and plotted as a semilogarithm plot of depth versus time. These plots are shown Appendix C Figures C1-C4. The shape of the curve indicates that the wells were constructed properly and are functioning. The Hvorslev method for determining hydraulic conductivity was applied to the data to give a crude approximation of the hydraulic conductivity.



NORTH

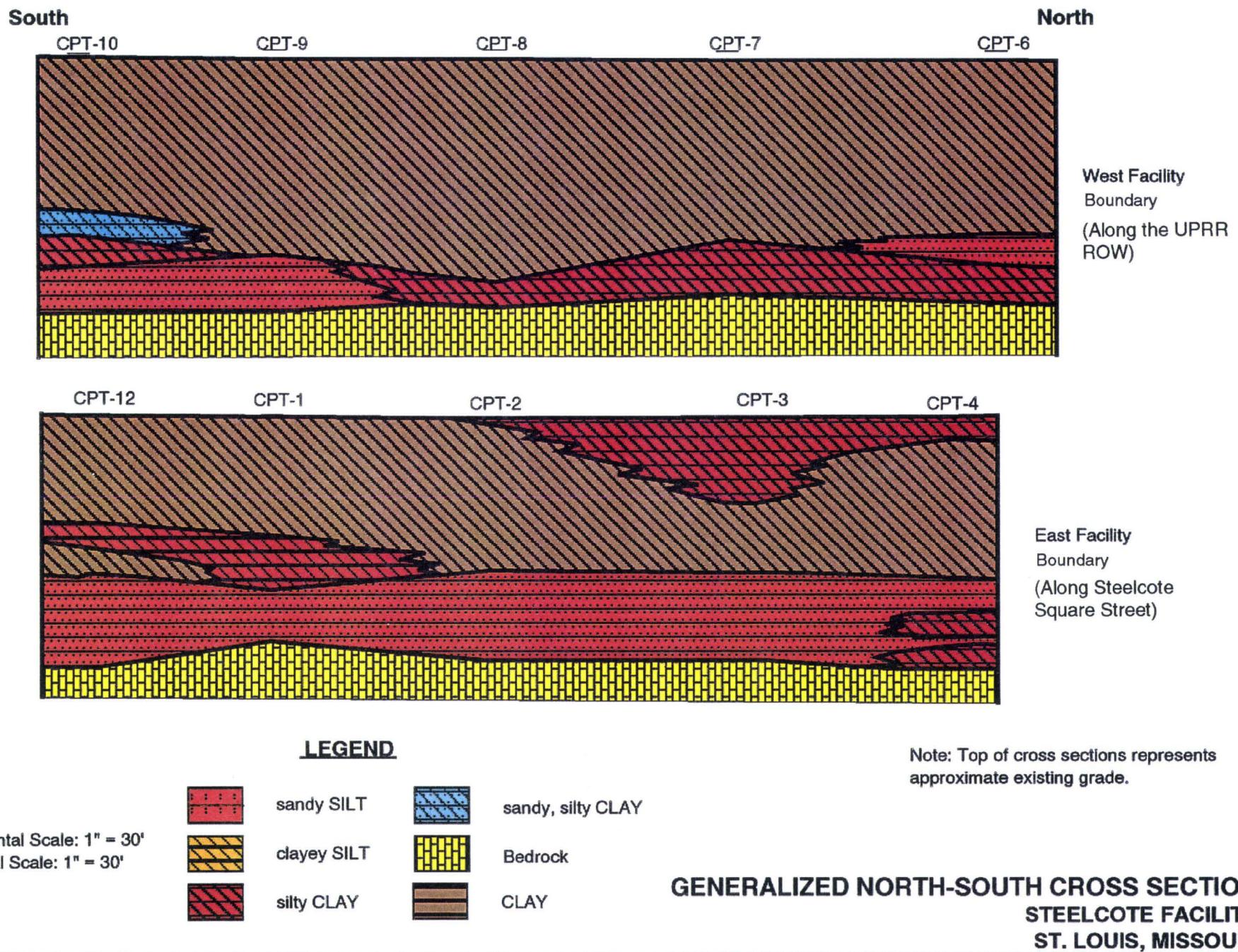
0 20 40 80  
Scale, in feet

#### LEGEND



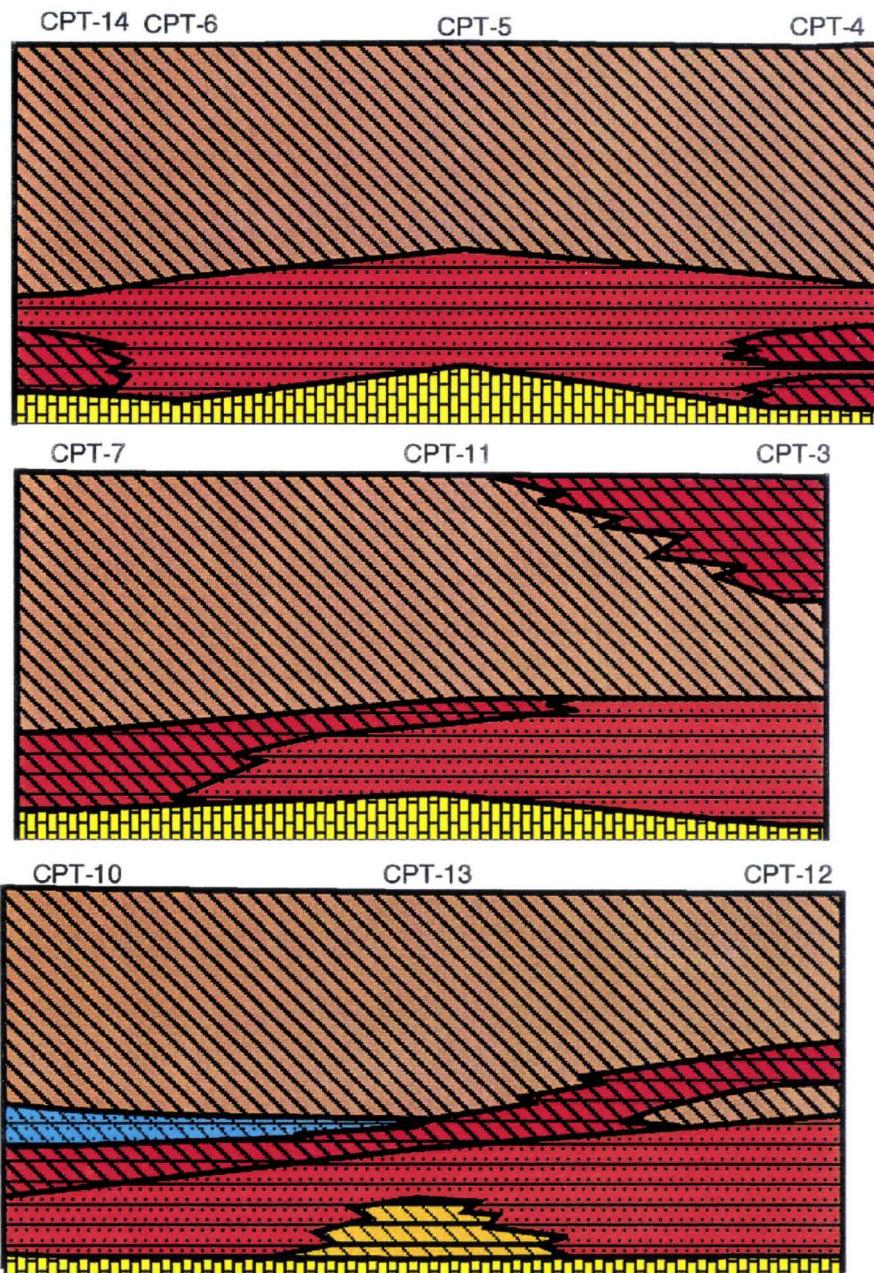
Approx. CPT location used  
for top of bedrock  
determination

**BEDROCK CONTOURS**  
**STEELCOTE FACILITY**  
**ST. LOUIS, MISSOURI**



East

West

LEGEND

	sandy SILT
	clayey SILT
	silty CLAY
	sandy, silty CLAY
	Bedrock
	CLAY

North Facility  
Boundary  
(Along Gratiot Street)

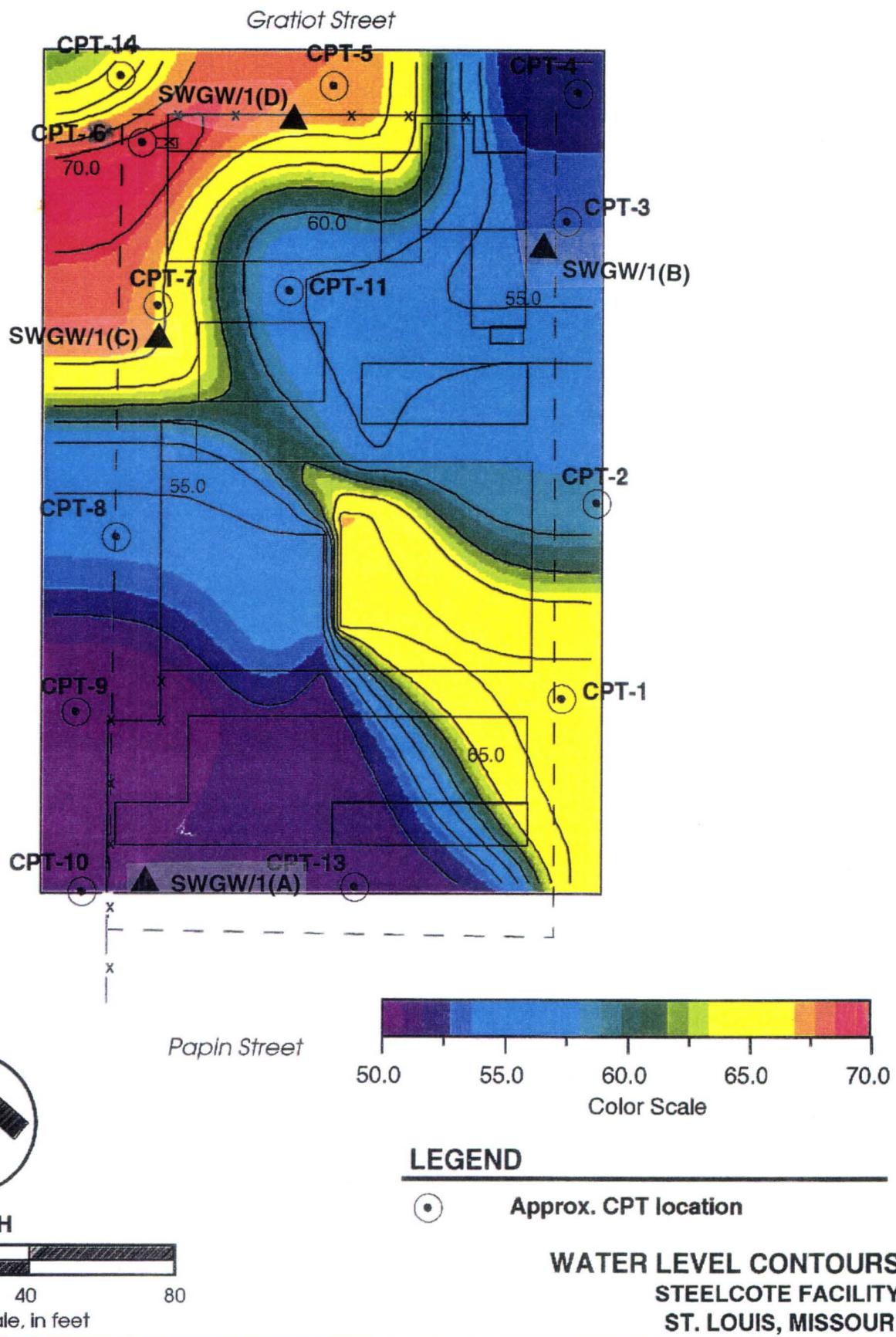
Central Facility  
Area

South Facility  
Boundary  
(Along Papin Street)

Note: Top of cross sections represents  
approximate existing grade.

Horizontal Scale: 1" = 30'  
Vertical Scale: 1" = 30'

**GENERALIZED EAST-WEST CROSS SECTION**  
**STEELCOTE FACILITY**  
**ST. LOUIS, MISSOURI**



The ratio of the change in head to the head at the start of the test ( $h/h_0$ ) was calculated and then plotted versus time on semilogarithmic paper and are shown in Appendix C Figures C4-C8. The time-drawdown data tended to plot in a straight line, as expected, with some deviation observed in Well A. The data suggests that the combined response of the filter pack and formation at the outset of the test shifted to reflect more the influence of the formation.

The hydraulic conductivity values calculated for the wells ranged from  $3.20 \times 10^{-6}$  to  $2.11 \times 10^{-5}$  cm/sec. These values are comparable to the calculated values from the slug tests conducted in May and June, 1992 when the hydraulic conductivities ranged from  $4.87 \times 10^{-5}$  to  $1.89 \times 10^{-5}$  cm/sec.

#### 4.0 CONCLUSIONS

The CPT investigation indicates that the subsurface geology across the site is consistent with the geology observed during the drilling, sampling, and monitoring well installation work conducted in Spring, 1992. Depth to bedrock was within the range previously encountered and the general stratigraphy was similar. No evidence of karst features or man-made structures was indicated by the CPT investigation. The presence of a confining layer or discreet and isolated water-bearing zones accountable for the observed ground water conditions were not identified in the interpreted soil data, however, the pore pressure data suggests that separate water-bearing zones may be present.

The CPT pore pressure data indicates ground water highs at the northwest and southeast ends of the site and ground water lows at the northeast and southwest areas of the site. It appears there are ground water "valleys" trending approximately northeast and southwest. The apparent direction of ground water flow is complex with indications that a ground water divide is present trending northwest-southeast. Although the ground water elevations are different from the four wells, the general pattern is similar to the apparent ground water flow direction based upon the wells. The pore pressure data indicates a complex ground water flow pattern and that water apparently leaves the site toward the west, northeast, and possibly northwest.

The reverse slug tests performed on the wells indicate the wells are working properly. Hydraulic conductivity values were similar in magnitude to those calculated from the slug tests conducted in Spring, 1992.

**TABLE 1**  
**QUARTERLY GROUND WATER ANALYTICAL RESULTS<sup>1</sup>**

<b>WELL SWGW/1(A)</b> <u>PARAMETER</u>	May 1992	Aug 1992	Nov 1992	Feb 1993	May 1993
	<u>1st Qtr</u>	<u>2nd Qtr</u>	<u>3rd Qtr</u>	<u>4th Qtr</u>	<u>5th Qtr</u>
Xylene	ND	ND	ND	23	ND
Toluene	ND	ND	ND	11	ND
Phthalate	3	ND	9	5	3
Barium	398	348	401	463	410
Chromium	4.0	ND	ND	ND	4.6
Lead	2.2	2.3	ND	6.9	1.6
Formaldehyde	800	50	54	25.3	ND
<b>WELL SWGW/1(B)</b>					
<u>PARAMETER</u>	<u>1st Qtr</u>	<u>2nd Qtr</u>	<u>3rd Qtr</u>	<u>4th Qtr</u>	<u>5th Qtr</u>
	ND	ND	ND	3	ND
Xylene	ND	ND	ND	ND	ND
Phthalate	11	ND	11	6	ND
Barium	470	500	512	736	680
Chromium	4.6	ND	ND	ND	7.7
Lead	ND	6.6	ND	4.6	48
Formaldehyde	170	22	12	39.4	ND

<sup>1</sup> Concentrations reported are in parts per billion (ppb)

**TABLE 1**  
**QUARTERLY GROUND WATER ANALYTICAL RESULTS<sup>1</sup>**

<b>WELL SWGW/1(C)</b> <u>PARAMETER</u>	May 1992	Aug 1992	Nov 1992	Feb 1993	May 1993
	<u>1st Qtr</u>	<u>2nd Qtr</u>	<u>3rd Qtr</u>	<u>4th Qtr</u>	<u>5th Qtr</u>
Xylene	10	12	730	47	4
Toluene	50	ND	2000	ND	620
Phthalate	4	ND	5	4	3
Barium	420	468	376	488	287
Chromium	5.3	ND	ND	ND	5.8
Lead	2.5	2.6	ND	5.8	7.4
Formaldehyde	380	31	83	52.7	ND
<b>WELL SWGW/1(D)</b>					
<u>PARAMETER</u>	<u>1st Qtr</u>	<u>2nd Qtr</u>	<u>3rd Qtr</u>	<u>4th Qtr</u>	<u>5th Qtr</u>
Xylene	2	2	7	1	5
Toluene	ND	ND	ND	ND	ND
Phthalate	72	ND	9	5	ND
Barium	658	392	644	562	511
Chromium	4.8	ND	ND	ND	5.3
Lead	1.4	2.3	ND	7.7	4.6
Formaldehyde	1100	25	41	41.8	ND

<sup>1</sup> Concentrations reported are in parts per billion (ppb)

## **5.0 LIMITATIONS**

The analyses and conclusions contained in this report are based on information provided through the client, the observed site conditions, personnel interviews, sampling and analysis, and other conditions described herein and further assume that the conditions observed are representative of the surface and subsurface conditions observed throughout the site. If conditions different from those described in the report are encountered, we should be advised at once so that we can review these conditions and reconsider our conclusions where necessary.

If conditions or site layout have changed due to natural causes or operations at or adjacent to the site, we recommend this report be reviewed to determine the applicability of conclusions considering the changed conditions and time lapse.

This report was prepared for the exclusive use of the client and his representatives for evaluating the site as it relates to the environmental aspects herein.

**APPENDIX A**  
**FIELD NOTES**

Weather: Overcast, humid ~82°  
08:30

June 14, 1983!

Personnel

Brotcke: Jeff  
Stan

Scott  
Mike

S.W.: Lawrence Rosen

Russell Schwab

08:45 Safety meeting

09:20 Set up on first location

Continued CPT testing the rest of day.

Completed Location 1, 2. First hole 3 (near well B) was  
questioned due to inclination >7°. Tried "3A" but generator  
cut out during test. Stopped work c~4 pm due to  
generator and completed grouting.

~17:00 Depart Site

Weather: Clear ~70° c07:30

June 15, 1997

LCR

07:30 Onsite - Brodbeck & crew present for CPT work.  
Set up at location #5 near well D. Work continued  
through the day w/ completion of locations 5 thru 10.  
~17:00 Graveling & cleanup completed.

17:15 Left site

Weather: Clear ~70° c 07:30

June 16, 1991

0730 LCK arrives. Brotske crew present for CPT work

0800 Begin first CPT location (#11). Continued work through the day and completed (in order) locations 11, 12, 13, 3B, 14, and 4.

5-16:10 Completed #4. Greeted and took down decomprod.

16:45 Site cleaned up and secure. Departed.

Partly Sunny 80° 9 in

June 29 1993

0900 Opposite - LCR + JLB. Start w/ taking water levels @ each well

SWGw/1 (A)	15.22	(Max) PID 14 ppm
SWGw/1 (B)	39.00	PID 160 ppm
SWGw/1 (C)	12.25 40.5	PID 114 ppm
SWGw/1 (D)	13.25	PID 125 ppm

0945 Begin slug test on SWGw/1(B). Water level @ 39.1' below TOC  
Need to bring water up to ~9.5' below TOC. Have ~29.6' to fill  
with water - need ~120 gals\*. Will fill the well with the  
available water (105 gals Absolute Distilled Water) and measure  
the water level. \* assumes 100% void space

~10:30 Was nearing 10' below TOC when water level indicator  
stopped working - apparently the battery failed. Stopped test.  
Had placed 52.5 gals down the well. Cleaned up site  
and prepared to leave.

10:50 Site secured.

10:55 Departed site.

Partly Cloudy ~84°

6/30/93

09:15 LCR: At site. Checked water level in well B. It was ~33.5' which is 5.5' feet higher than yesterday. Does not seem attributable to overnight rains since Well C is @ 39.81 relative to 10.5' yesterday. Therefore, 'B' will not be done today.

09:45 Set up on 'C'. Water level c 39.81' below TOC. To bring water to 10' below TOC will need ~121 gallons assuming the annulus is void. Since it wont assume ~50% void space. Therefore anticipate between 55 and 60 gals to raise water level to desired height to start test. Added 80.75 gallons

10:30 Start Test

Time	Reading	Time	Reading	Time	Reading
:05	12.2	1:00	14:42	3:30	20.6
:08	12.51	1:10		3:45	21.0
:05		1:20	15.33	4:00	21.35
:20	12.75	1:30	15.6	4:15	21.45
:25		1:45	16.0	4:30	23.4
:30	13.0	2:00	16.6	4:45	23.65
:35	13.3	2:15	17.95	5:00	24.51
:40	13.3	2:30	18.23	5:15	24.95
:45		2:45	19.4	5:30	25.25
:50	13.4	3:00	19.6	5:45	25.65
:55		3:15	20.1	6:00	25.90

6/30/93

Time	Reading	Time	Reading	Time	Reading
6:15	26.85	12:15	34.0	23:00	37.43
6:30	27.30	12:30	34.35	24:00	37.62
6:45	27.60	12:45	34.44	25:00	37.78
7:00	27.80	13:00	34.55	27:00	37.95
7:15	28.10	13:15	34.68	29:00	38.02
7:30	28.40	13:30	34.78	31:00	38.15
7:45	29.16	13:45	34.85	<del>33:00</del>	
8:00	29.35	14:00	34.95	35:00	38.27
8:15	29.80	14:15	35.02	40:00	38.33
8:30	30.15	14:30	35.20	45:00	38.40
8:45	30.50	14:45	35.40	End of Rest	
9:00	30.81	15:00	35.45		
9:15	31.15	15:30	35.55		
9:30	31.4	16:00	35.65		
9:45	31.6	16:30	35.80		
10:00	31.9	17:00	35.93		
10:15	32.25	17:30	36.03		
10:30	32.45	18:00	36.23		
10:45	32.70	18:30	36.40		
11:00	32.95	19:00	36.50		
11:15	33.20	19:30	36.63		
11:30	33.40	20:00	36.75		
11:45	33.60	21:00	37.00		
12:00	33.80	22:00	37.22		

03/09/93

11:15 Went to well 'D'. Water level @ 13.56 below TDC. Prepared to add water for slug test. Meter problems. Went to Well A

12:30 Well A @ 15.40 below TDC.

Time	Reading	Time	Reading	Time	Reading
0:05	7.1	1:45	9.5	4:50	12.65
0:10	7.35	1:50	9.6	5:00	12.95
0:15	7.56	1:55	9.75	5:10	13.35
0:20	7.65	2:00	9.8	5:20	13.60
0:25	7.80	2:10	9.95	5:30	13.85
0:30	7.95	2:20	10.05	5:40	14.25
0:35	8.00	2:30	10.15	5:50	14.45
0:40	8.10	2:40	10.25	6:00	14.65
0:45	8.20	2:50	10.4	6:15	
0:50	8.30	3:00	10.58	6:30	
0:55	8.40	3:10	10.70	6:45	
0:60	8.50	3:20	10.85	7:00	
1:05	8.62	3:30	10.95	7:15	
1:10	8.70	3:40	11.1	7:30	
1:15	8.80	3:50	11.3	7:45	
1:20	8.90	4:00	11.5	8:00	
1:25	8.1	4:10	11.75		
1:30	9.2	4:20	11.95	Operator error	
1:35	9.3	4:30	12.25	void test.	
1:40	9.4	4:40	12.45		

Partly Cloudy 85°

July 2 1983

0900 LVR - TLB to complete string tests on wells B, A & D.

0910 Water level in Well B is 35.95 below T.O.C. Began to add water (absolute distilled) - 31 g/min

0920 Start test

Time	Reading	Time	Reading	Time	Reading
0:05	8.85	1:35	10.8	3:30	11.6
0:10		1:40	10.00	3:40	11.7
0:15		1:45	11.0	3:50	11.8
0:20	9.2	1:50	11.2	4:00	11.85
0:25	9.45	1:55		4:10	11.9
0:30	9.60	2:00	11.4	4:20	12.0
0:35	9.70	2:05	11.6	4:30	12.05
0:40	9.90	2:10	11.7	4:40	12.15
0:45	10.0	2:15		4:50	12.20
0:50	10.1	2:20		5:00	12.25
0:55	10.2	2:25		5:10	12.3
0:60	10.35	2:30	11.5	5:20	12.40
1:05	10.45	2:45		5:30	12.45
1:10	10.50	2:50		5:40	12.50
1:15	10.60	2:55		5:50	12.60
1:20	10.65	3:00	11.3	6:00	12.65
1:25	10.70	3:10	11.45	6:10	12.71
1:30		3:20	11.5	6:20	12.80

9/2/93

Time	Reading	Time	Reading	Time	Reading
6:30	12.85	12:00	15.10	4:00	22.65
6:40	12.90	12:30	15.30	4:30	24.00
6:50	13.00	13:00	15.45	5:00	(as 40 e 51:15) 25.20
7:00	13.10	13:30	15.60	5:30	26.15
7:15	13.20	14:00	15.80	6:00	27.20
7:30	13.30	14:30	15.95	6:30	28.10
7:45	13.40	15:00	16.10	7:00	28.75
8:00	13.50	16:00	16.45		<u>end test</u>
8:15	13.60	17:00	16.75		
8:30	13.70	18:00	17.00		
8:45	13.80	19:00	17.30		
9:00	13.95	20:00	17.60		
9:15	—	21:00	17.95		
9:30	14:15	22:00	18.25		
9:45	14.25	23:00	18.50		
10:00	14.35	24:00	18.85		
10:15	14.45	25:00	19.15		
10:30	14.55	26:00	19.50		
10:45	14.65	27:00	19.75		
11:00	14.75	28:00	20.00		
11:15	14.85	29:00	20.30		
11:30	14.95	30:00	20.50		
11:45	15.00	35:00	21.75		

7/2/63

10:35 Set up on Well D. Water level @ 13.1 below TDC  
Add water - 3 gallons

Start Test

Time Reading Time Reading Time Reading

0:05 7.95 1:40 9:30 4:20 10.60

0:10 8.05 1:45 9:40 4:30 10.65

0:15 8.15 1:50 9:45 4:40 10.70

0:20 8.25 1:55 9:50 4:50 10.75

0:25 8.30 2:00 9:55 5:00 10.80

0:30 8.40 2:10 9.60 5:10 10.85

0:35 8.45 2:20 9.70 5:20 10.90

0:40 8.55 2:30 9.80 5:30 10.95

0:45 8.60 2:40 9.90 5:40 11.00

0:50 8.70 2:50 9.95 5:50 11.05

0:55 8.75 3:00 10.00 6:00 11.10

1:00 8.80 3:10 10.10 6:15 11.15

1:05 8.90 3:20 10.15 6:30 11.25

1:10 8.95 3:30 10.25 6:45 11.35

1:15 9.00 3:40 10.30 7:00 11:40

1:20 9.05 3:50 10.40 7:15 11:50

1:30 9.20 9:00 10.45 7:30 11:55

1:35 9.25 9:10 10.50 7:45 11.60

7/2/93

	Time	Reading	Time	Reading
	8:00	11.65		
	8:15	11.70	8:45	11.85
	8:30	11.80	9:00	11.88
	9:15	11.90	9:45	—
	9:30	11.93	10:00	12.52
	9:45	—	10:30	—
	10:00	12.05	10:45	—
	10:30	12.15	11:00	—
	10:45	—	11:30	12.20
	11:00	12.20	11:15	—
	11:30	12.26	11:45	—
	12:00	12.35	12:30	—
	12:30	—	13:00	12.36
	13:00	—	13:30	—
	13:30	—	14:00	12.39
	14:00	—	14:30	—
	14:30	—	15:00	12.41
	15:00	—	15:30	—
	15:30	—	16:00	12.44
	16:00	—	16:30	—

7/2/93

11:25 Set up in Well A. Water level @ 13.55 below TDC.

Added water ~ 2.6 gallons

Start Test

Time	Reading	Time	Reading	Time	Reading
0:05	8.05	1:45	9.70	5:15	11.35
0:10	8.15	1:50	9.80	5:30	11.42
0:15	8.30	1:55	9.85	5:45	11.50
0:20	8.45	2:00	9.90	6:00	11.56
0:25	8.50	2:10	10.00	6:15	—
0:30	8.60	2:20	10.10	6:30	11.70
0:35	8.70	2:30	10.20	6:45	—
0:40	8.80	2:40	10.30	7:00	11.80
0:45	8.90	2:50	10.40	7:30	11.90
0:50	8.95	3:00	10.50	8:00	12.00
0:55	9.05	3:10	10.55	8:30	12.08
1:00	9.15	3:20	10.65	9:00	12.15
1:05	9.20	3:30	10.70	9:30	12.21
1:10	9.30	3:40	10.80	10:00	12.29
1:15	9.35	3:50	10.85	11:00	12.39
1:20	9.40	4:00	10.95	12:00	12.48
1:25	9.50	4:15	11.00	15:00	12.67
1:30	9.55	4:30	11.10	20:00	12.87
1:35	9.60	4:45	11.20	25:00	13.00
1:40	9.65	5:00	11.30	30:00	13.04

2nd Test

**APPENDIX B**

**CONE PENETROMETER TEST DATA**

**Interpreted CPT Profile**

Operator :s&w  
On Site Loc:CPT-1  
Job No. :Z-301-05  
Tot. Unit Wt. (avg) : 120 pcf

CPT Date :06/14/93 10:20  
Cone Used :#1  
Water table ( feet ) : 28.78576

DEPTH (feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
1	9.07	0.19	2.06	0.03	clayey silt to silty clay	UNDFND	UNDFD	4	.6
2	16.90	0.14	0.81	0.09	sandy silt to clayey silt	UNDFND	UNDFD	6	1.1
3	4.17	0.05	1.20	0.15	sensitive fine grained	UNDFND	UNDFD	2	.2
4	11.65	0.32	2.77	0.22	silty clay to clay	UNDFND	UNDFD	7	.7
5	6.13	0.17	2.74	0.28	clay	UNDFND	UNDFD	6	.3
6	10.47	0.28	2.66	0.33	silty clay to clay	UNDFND	UNDFD	7	.6
7	5.15	0.18	3.47	0.39	clay	UNDFND	UNDFD	5	.3
8	7.97	0.24	2.97	0.45	silty clay to clay	UNDFND	UNDFD	5	.5
9	8.52	0.35	4.15	0.51	clay	UNDFND	UNDFD	8	.5
10	16.70	0.71	4.23	0.57	clay	UNDFND	UNDFD	16	1.0
11	10.45	0.33	3.20	0.63	silty clay to clay	UNDFND	UNDFD	7	.6
12	9.95	0.51	5.12	0.69	clay	UNDFND	UNDFD	10	.6
13	14.62	0.92	6.32	0.75	clay	UNDFND	UNDFD	14	.9
14	13.87	0.84	6.02	0.81	clay	UNDFND	UNDFD	13	.8
15	11.57	0.65	5.58	0.87	clay	UNDFND	UNDFD	11	.7
16	10.72	0.52	4.89	0.93	clay	UNDFND	UNDFD	10	.6
17	8.92	0.39	4.39	0.98	clay	UNDFND	UNDFD	9	.5
18	7.55	0.35	4.58	1.04	clay	UNDFND	UNDFD	7	.4
19	5.82	0.32	5.49	1.10	clay	UNDFND	UNDFD	6	.3
20	6.13	0.28	4.59	1.16	clay	UNDFND	UNDFD	6	.3
21	6.66	0.29	4.30	1.23	clay	UNDFND	UNDFD	6	.3
22	5.42	0.26	4.85	1.29	clay	UNDFND	UNDFD	5	.2
23	7.08	0.30	4.19	1.35	clay	UNDFND	UNDFD	7	.3
24	8.41	0.48	5.68	1.41	clay	UNDFND	UNDFD	8	.4
25	11.37	0.54	4.72	1.48	clay	UNDFND	UNDFD	11	.6
26	12.93	0.47	3.67	1.54	silty clay to clay	UNDFND	UNDFD	8	.7
27	10.48	0.43	4.07	1.59	clay	UNDFND	UNDFD	10	.5
28	9.00	0.28	3.07	1.65	silty clay to clay	UNDFND	UNDFD	6	.4
29	13.23	0.36	2.72	1.71	clayey silt to silty clay	UNDFND	UNDFD	6	.7
30	20.35	0.33	1.62	1.75	sandy silt to clayey silt	UNDFND	UNDFD	8	1.2
31	16.40	0.40	2.47	1.78	clayey silt to silty clay	UNDFND	UNDFD	8	.9
32	13.52	0.20	1.50	1.80	clayey silt to silty clay	UNDFND	UNDFD	6	.7
33	10.63	0.23	2.21	1.83	clayey silt to silty clay	UNDFND	UNDFD	5	.5
34	9.87	0.30	2.99	1.86	silty clay to clay	UNDFND	UNDFD	6	.5
35	14.48	0.23	1.61	1.89	clayey silt to silty clay	UNDFND	UNDFD	7	.8
36	11.23	0.23	2.02	1.92	clayey silt to silty clay	UNDFND	UNDFD	5	.6
37	10.10	0.31	3.07	1.95	silty clay to clay	UNDFND	UNDFD	6	.5
38	14.08	0.20	1.44	1.97	clayey silt to silty clay	UNDFND	UNDFD	7	.7
39	12.28	0.21	1.75	2.00	clayey silt to silty clay	UNDFND	UNDFD	6	.6
40	10.65	0.23	2.19	2.03	clayey silt to silty clay	UNDFND	UNDFD	5	.5
41	24.05	0.53	2.20	2.06	sandy silt to clayey silt	UNDFND	UNDFD	9	1.4
42	36.34	1.23	3.39	2.09	clayey silt to silty clay	UNDFND	UNDFD	17	2.2
43	55.77	1.67	2.99	2.12	sandy silt to clayey silt	UNDFND	UNDFD	21	3.5
44	51.80	1.24	2.39	2.15	sandy silt to clayey silt	UNDFND	UNDFD	20	3.2
45	35.11	1.01	2.87	2.18	sandy silt to clayey silt	UNDFND	UNDFD	13	2.1
46	43.55	1.47	3.38	2.21	clayey silt to silty clay	UNDFND	UNDFD	21	2.7
47	45.93	1.11	2.42	2.24	sandy silt to clayey silt	UNDFND	UNDFD	18	2.8
48	34.55	0.73	2.11	2.27	sandy silt to clayey silt	UNDFND	UNDFD	13	2.1
49	36.25	0.89	2.46	2.30	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
50	34.05	0.80	2.34	2.32	sandy silt to clayey silt	UNDFND	UNDFD	13	2.0
51	34.18	0.75	2.20	2.35	sandy silt to clayey silt	UNDFND	UNDFD	13	2.0
52	35.57	0.91	2.56	2.38	sandy silt to clayey silt	UNDFND	UNDFD	14	2.1
53	39.22	0.70	1.77	2.41	sandy silt to clayey silt	UNDFND	UNDFD	15	2.4

Dr - All sands (Jamiolkowski et al. 1985)

PHI - Robertson and Campanella 1983

Su: Nk= 15

\*\*\*\* Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) \*\*\*\*



















## Interpreted CPT Profile

Operator :&w  
 On Site Loc:CPT-11  
 Job No. :Z-301-05  
 Tot. Unit Wt. (avg) : 123 pcf

CPT Date :06/16/93 8:00 s  
 Cone Used :#1  
 Water table ( feet ) : 39.0748

DEPTH (feet)	QC (avg) (tsf)	FS (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
1	4.07	0.15	3.75	0.03	clay	UNDFND	UNDFD	4	.2
2	22.15	0.55	2.48	0.09	clayey silt to silty clay	UNDFND	UNDFD	11	1.4
3	17.49	0.35	1.99	0.16	clayey silt to silty clay	UNDFND	UNDFD	8	1.1
4	16.70	0.21	1.25	0.22	sandy silt to clayey silt	UNDFND	UNDFD	6	1.0
5	4.60	0.23	4.98	0.28	clay	UNDFND	UNDFD	4	.2
6	2.63	0.19	7.22	0.34	organic material	UNDFND	UNDFD	3	.1
7	3.78	0.39	10.35	0.40	undefined	UNDFND	UNDFD	UDF	UNDEFINED
8	5.65	0.49	8.69	0.46	undefined	UNDFND	UNDFD	UDF	UNDEFINED
9	6.58	0.54	8.17	0.52	undefined	UNDFND	UNDFD	UDF	UNDEFINED
10	7.83	0.45	5.78	0.59	clay	UNDFND	UNDFD	8	.4
11	6.15	0.37	6.00	0.65	clay	UNDFND	UNDFD	6	.3
12	5.65	0.32	5.60	0.71	clay	UNDFND	UNDFD	5	.3
13	5.52	0.31	5.60	0.77	clay	UNDFND	UNDFD	5	.3
14	4.97	0.41	8.19	0.83	undefined	UNDFND	UNDFD	UDF	UNDEFINED
15	6.40	0.51	7.97	0.89	clay	UNDFND	UNDFD	6	.3
16	6.50	0.45	6.85	0.95	clay	UNDFND	UNDFD	6	.3
17	7.13	0.46	6.50	1.01	clay	UNDFND	UNDFD	7	.4
18	10.52	0.51	4.89	1.07	clay	UNDFND	UNDFD	10	.6
19	8.58	0.44	5.11	1.13	clay	UNDFND	UNDFD	8	.4
20	8.60	0.37	4.29	1.19	clay	UNDFND	UNDFD	8	.4
21	6.04	0.32	5.32	1.26	clay	UNDFND	UNDFD	6	.3
22	4.53	0.26	5.76	1.32	clay	UNDFND	UNDFD	4	.2
23	4.83	0.27	5.61	1.38	clay	UNDFND	UNDFD	5	.2
24	6.26	0.30	4.80	1.45	clay	UNDFND	UNDFD	6	.3
25	4.90	0.19	3.91	1.51	clay	UNDFND	UNDFD	5	.2
26	8.63	0.27	3.13	1.57	silty clay to clay	UNDFND	UNDFD	6	.4
27	5.50	0.17	3.14	1.63	clay	UNDFND	UNDFD	5	.2
28	7.23	0.18	2.47	1.69	silty clay to clay	UNDFND	UNDFD	5	.3
29	8.80	0.31	3.55	1.76	clay	UNDFND	UNDFD	8	.4
30	9.65	0.40	4.16	1.82	clay	UNDFND	UNDFD	9	.5
31	20.30	0.39	1.94	1.88	sandy silt to clayey silt	UNDFND	UNDFD	8	1.2
32	7.22	0.27	3.76	1.94	clay	UNDFND	UNDFD	7	.3
33	8.47	0.27	3.21	2.00	clay	UNDFND	UNDFD	8	.4
34	14.83	0.54	3.64	2.06	silty clay to clay	UNDFND	UNDFD	9	.8
35	17.98	0.35	1.92	2.12	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
36	11.38	0.52	4.60	2.18	clay	UNDFND	UNDFD	11	.6
37	40.10	1.49	3.71	2.24	clayey silt to silty clay	UNDFND	UNDFD	19	2.5
38	23.28	0.82	3.51	2.30	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
39	30.77	0.76	2.47	2.36	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
40	27.07	0.74	2.73	2.41	clayey silt to silty clay	UNDFND	UNDFD	13	1.6
41	29.73	0.61	2.06	2.44	sandy silt to clayey silt	UNDFND	UNDFD	11	1.8
42	15.69	0.25	1.59	2.47	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
43	26.90	0.67	2.49	2.51	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
44	40.57	0.86	2.12	2.54	sandy silt to clayey silt	UNDFND	UNDFD	16	2.5
45	35.99	0.76	2.12	2.57	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
46	36.88	0.73	1.97	2.60	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
47	28.65	0.52	1.83	2.63	sandy silt to clayey silt	UNDFND	UNDFD	11	1.7
48	26.97	0.57	2.11	2.66	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
49	25.00	0.46	1.85	2.69	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
50	28.72	0.67	2.32	2.72	sandy silt to clayey silt	UNDFND	UNDFD	11	1.7
51	26.87	0.47	1.74	2.75	sandy silt to clayey silt	UNDFND	UNDFD	10	1.5
52	30.28	0.69	2.28	2.78	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8

Dr - All sands (Jamiolkowski et al. 1985)

PHI - Robertson and Campanella 1983

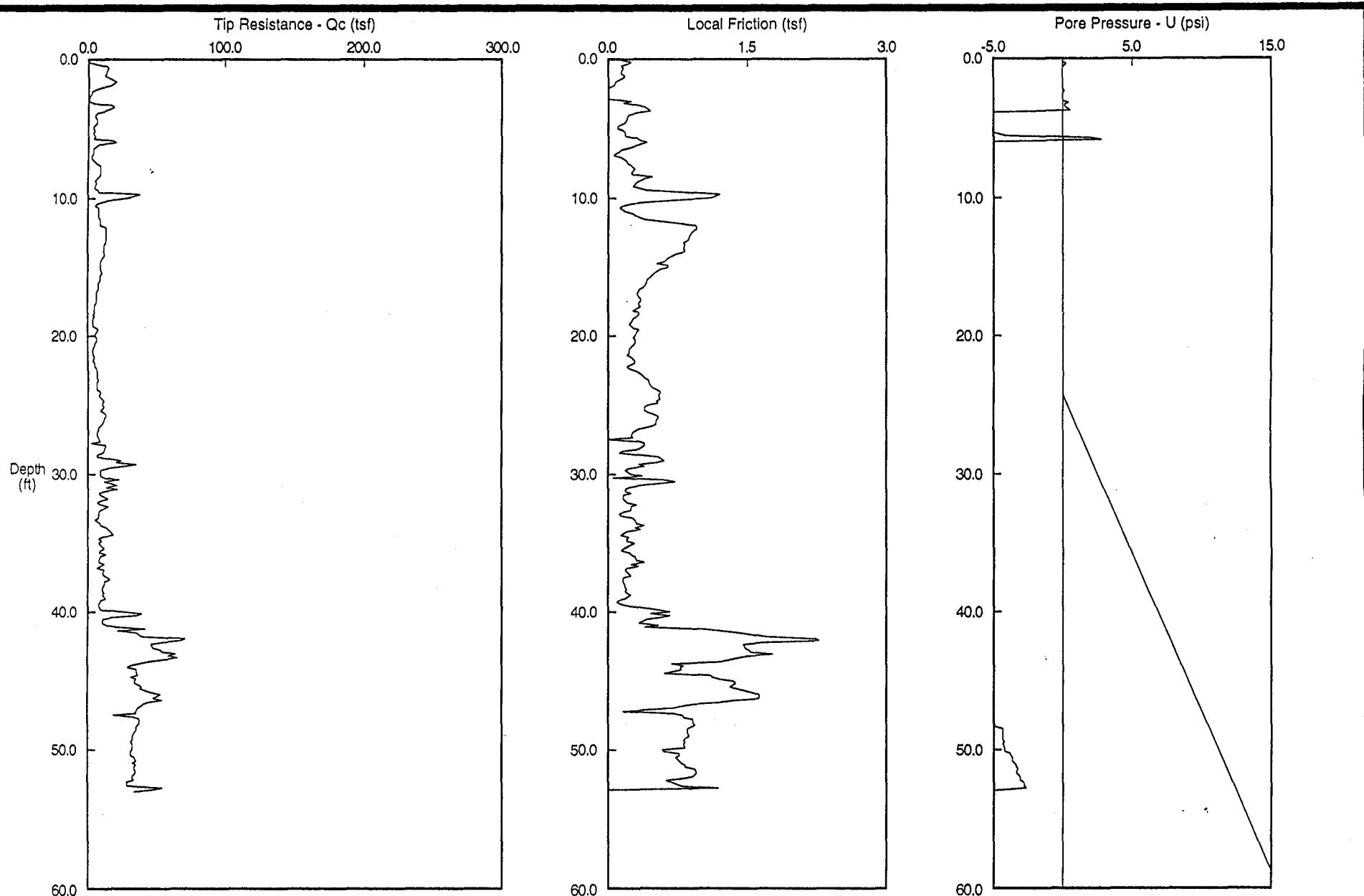
Su: Nk= 15

\*\*\*\* Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) \*\*\*\*

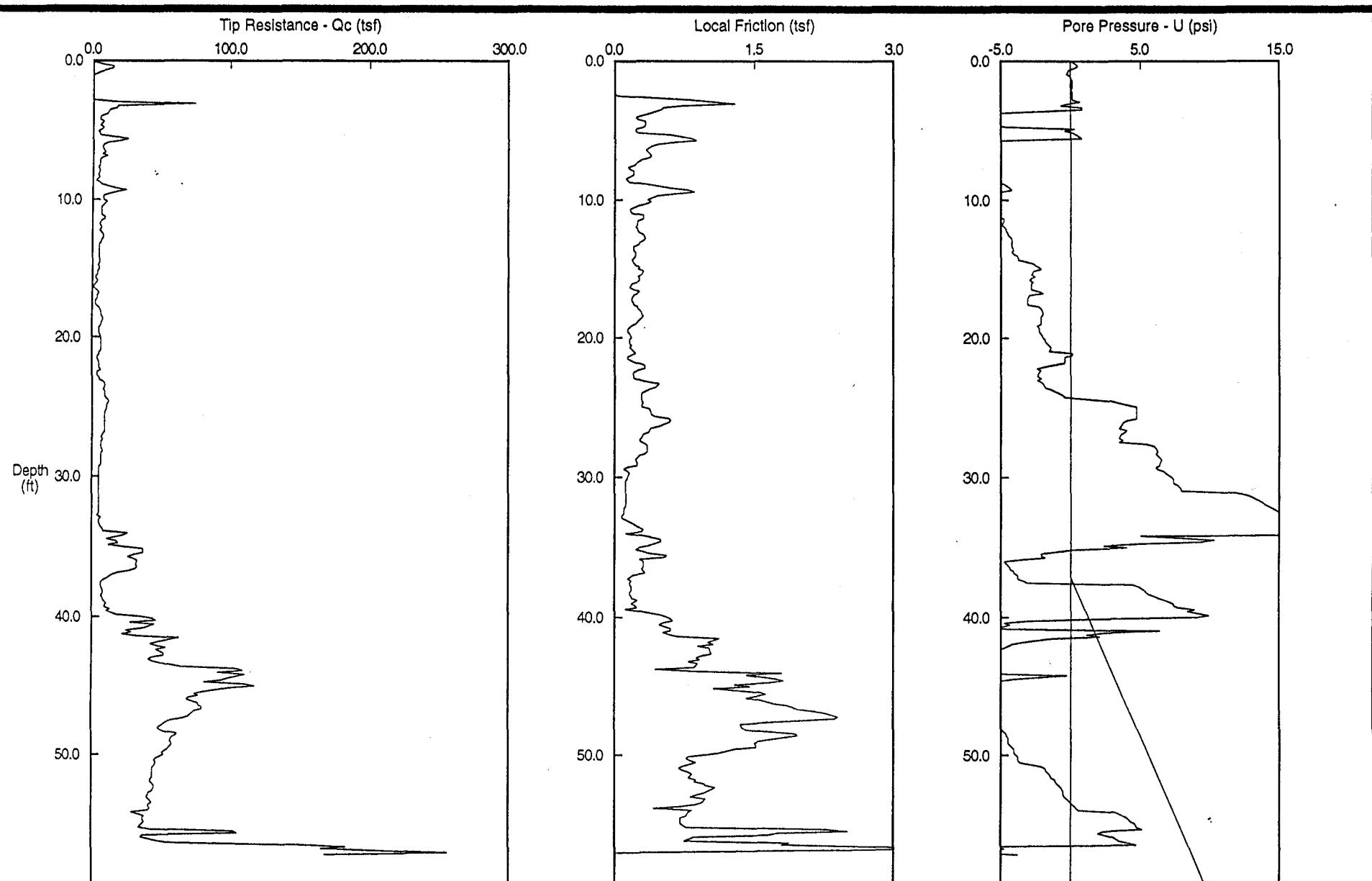




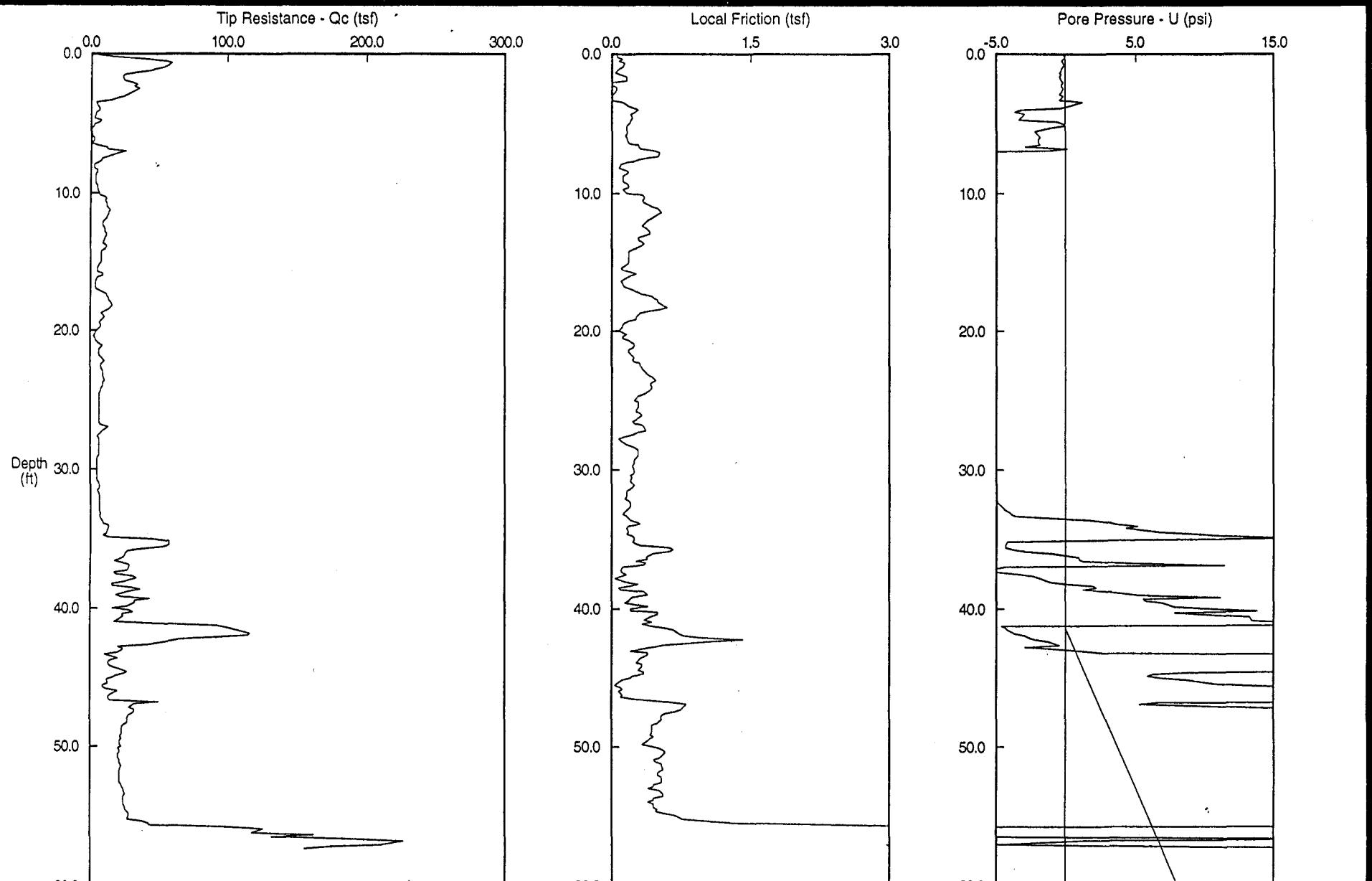




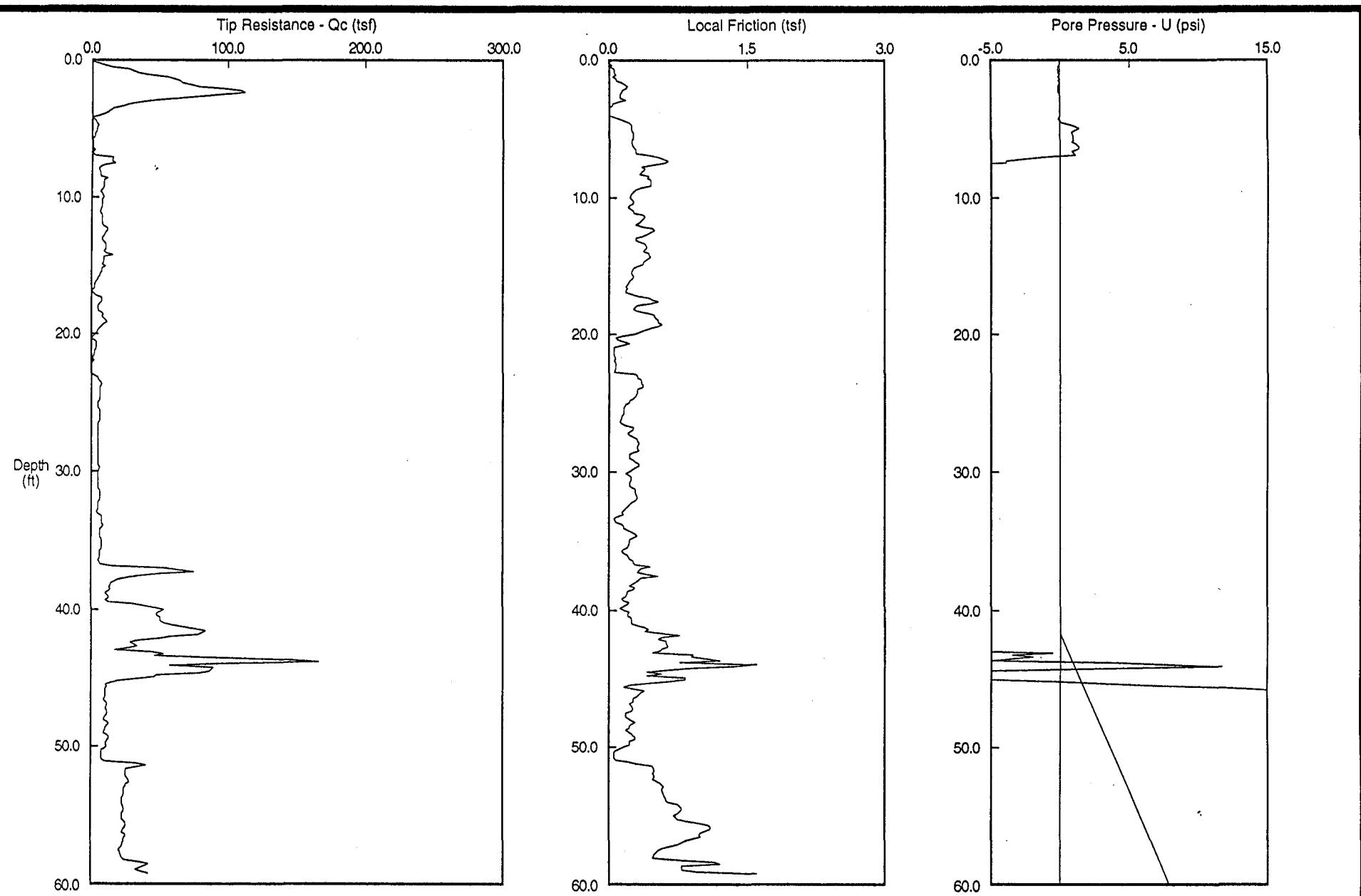
PLOT OF CPT-1  
Steelcote



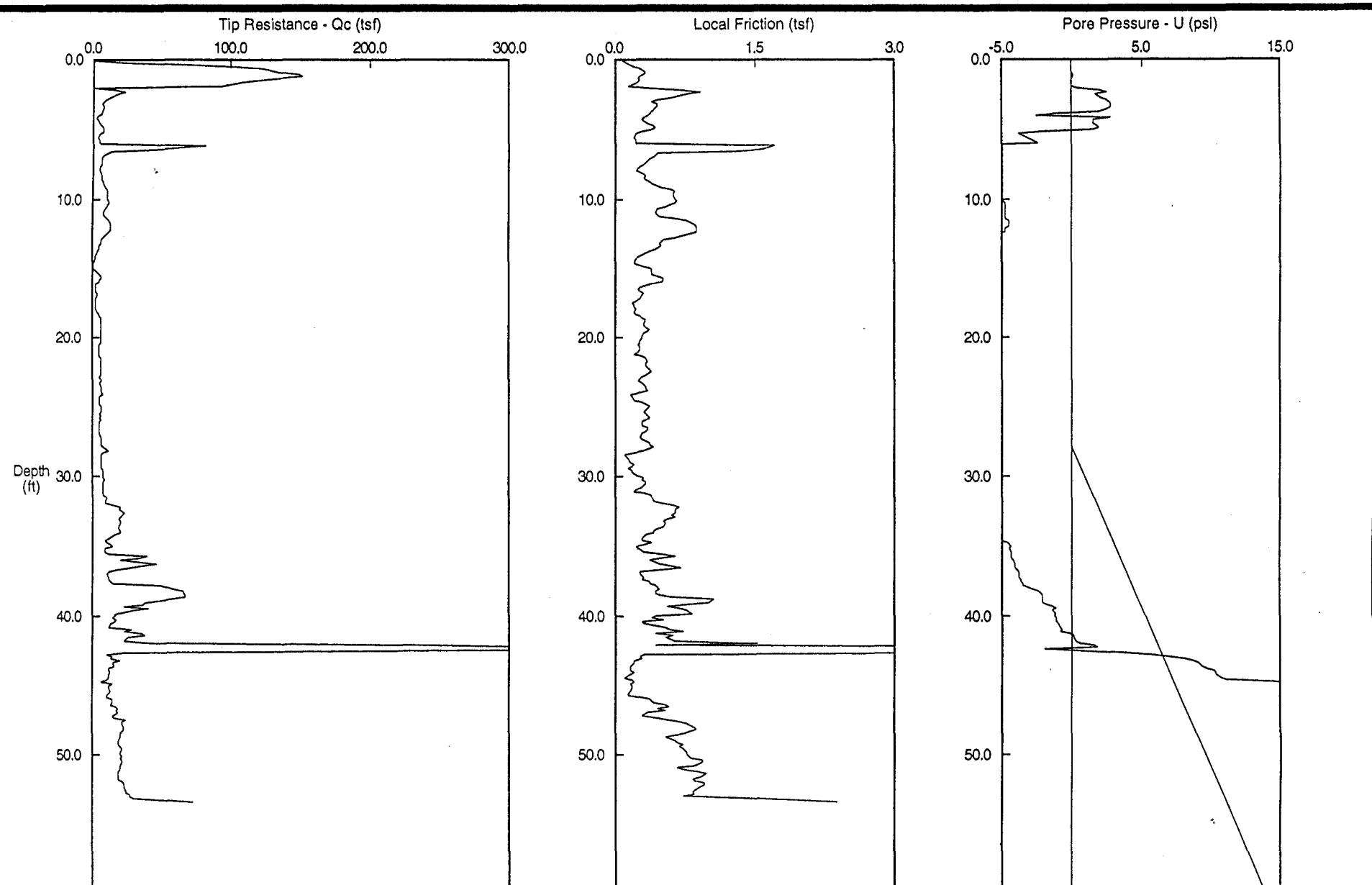
PLOT OF CPT-2  
Steelcote



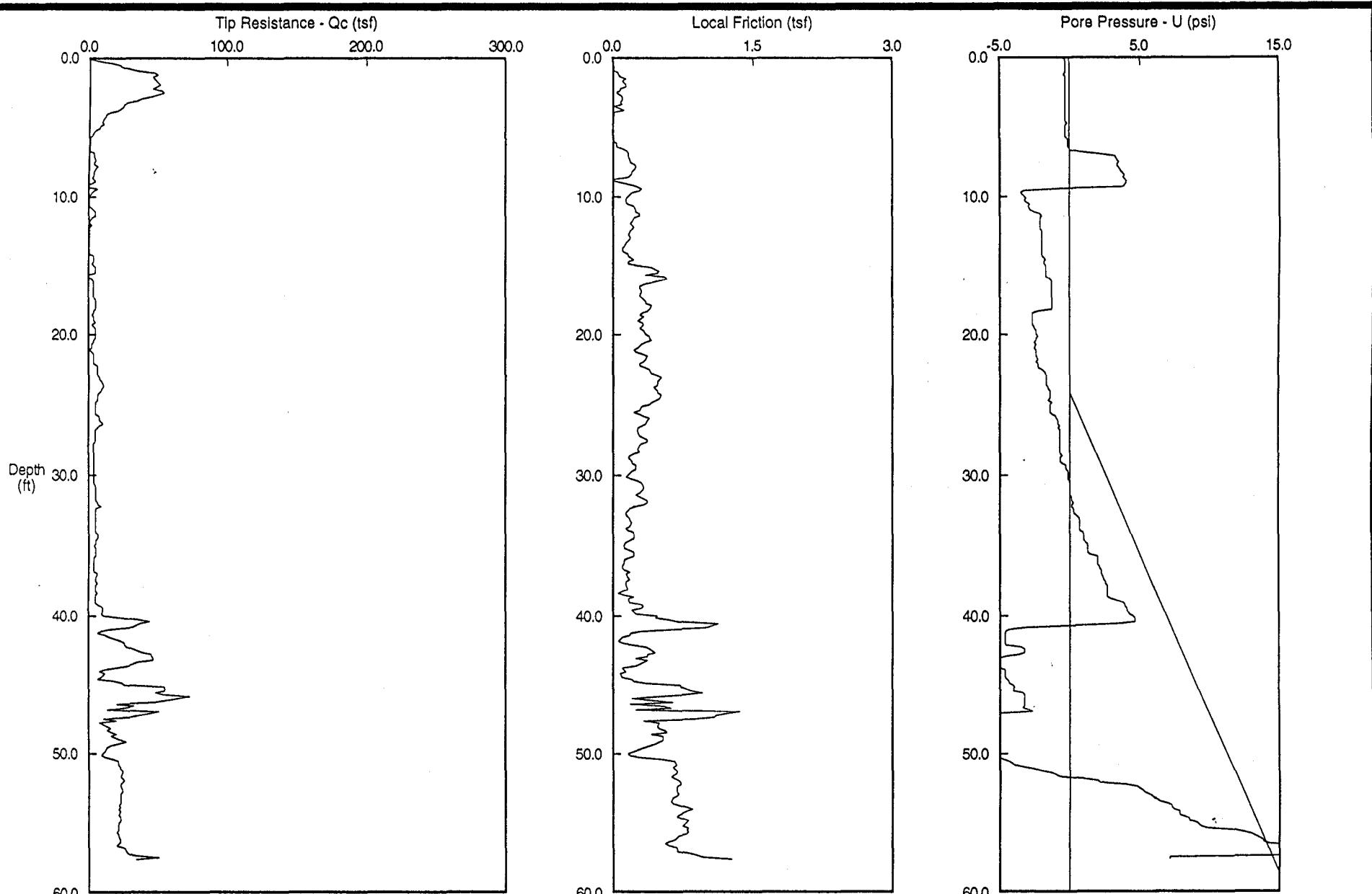
PLOT OF CPT-3B  
Steelcote



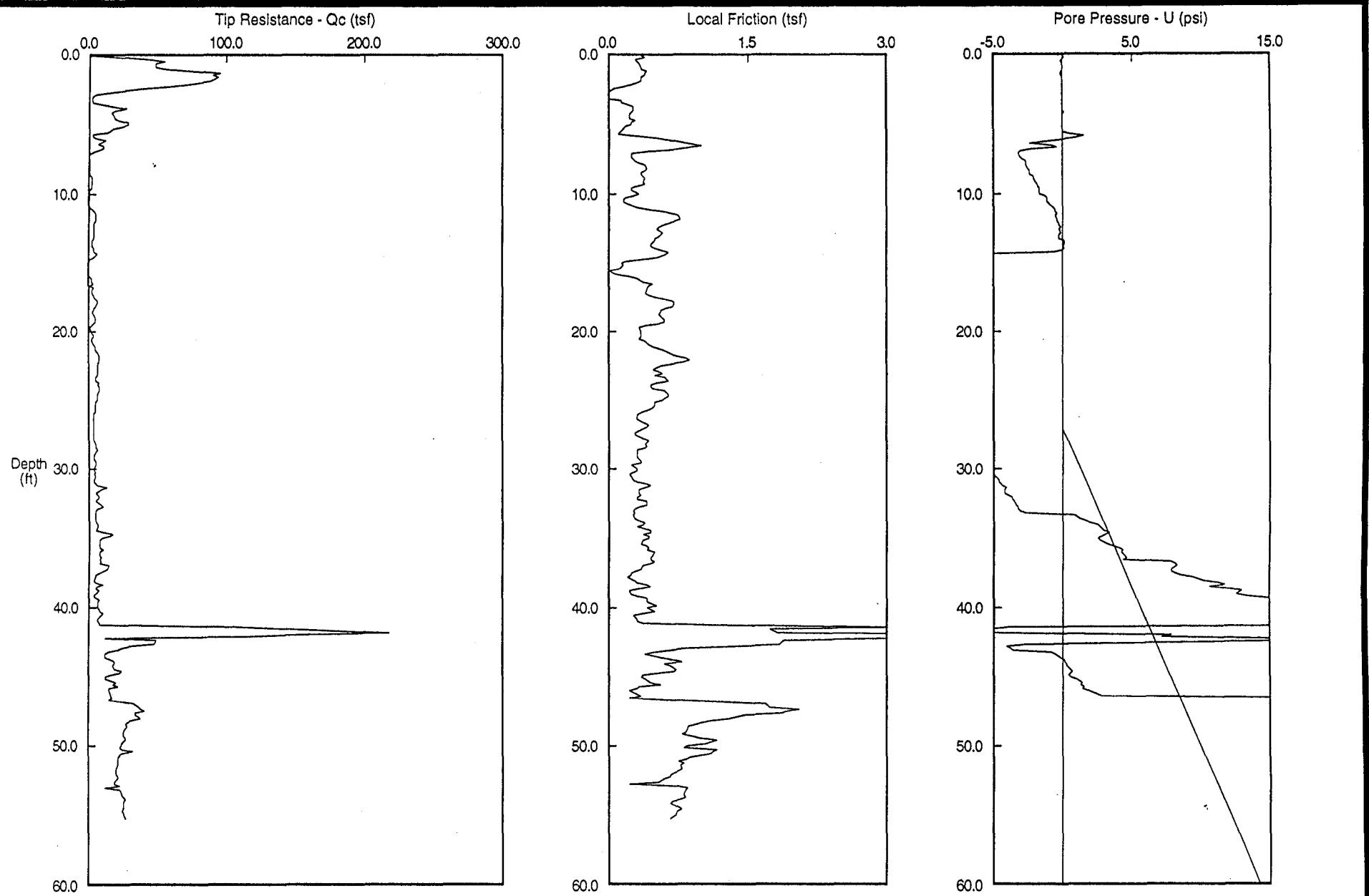
PLOT OF CPT-4  
Steelcote



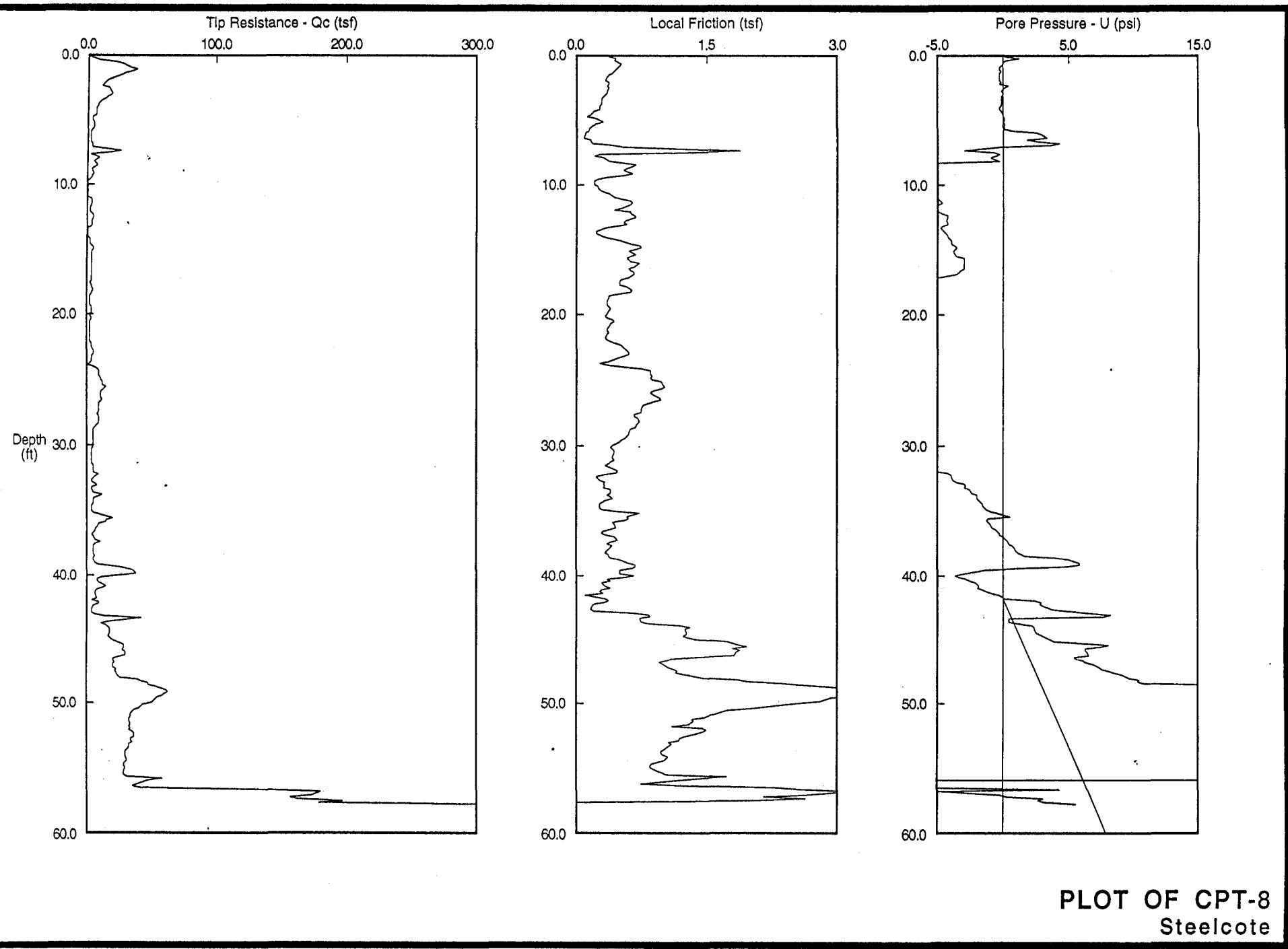
PLOT OF CPT-5  
Steelcote

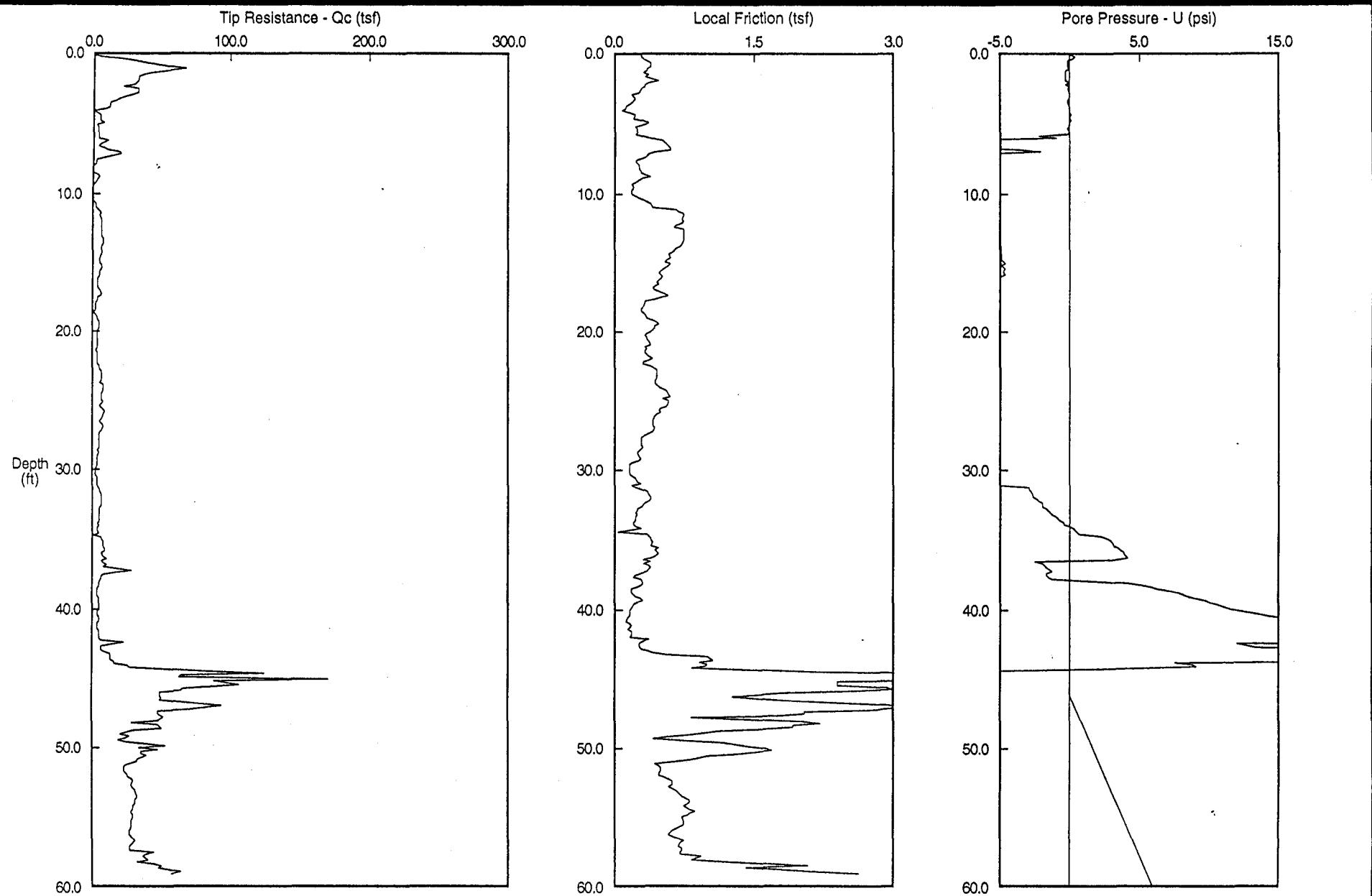


PLOT OF CPT-6  
Steelcote

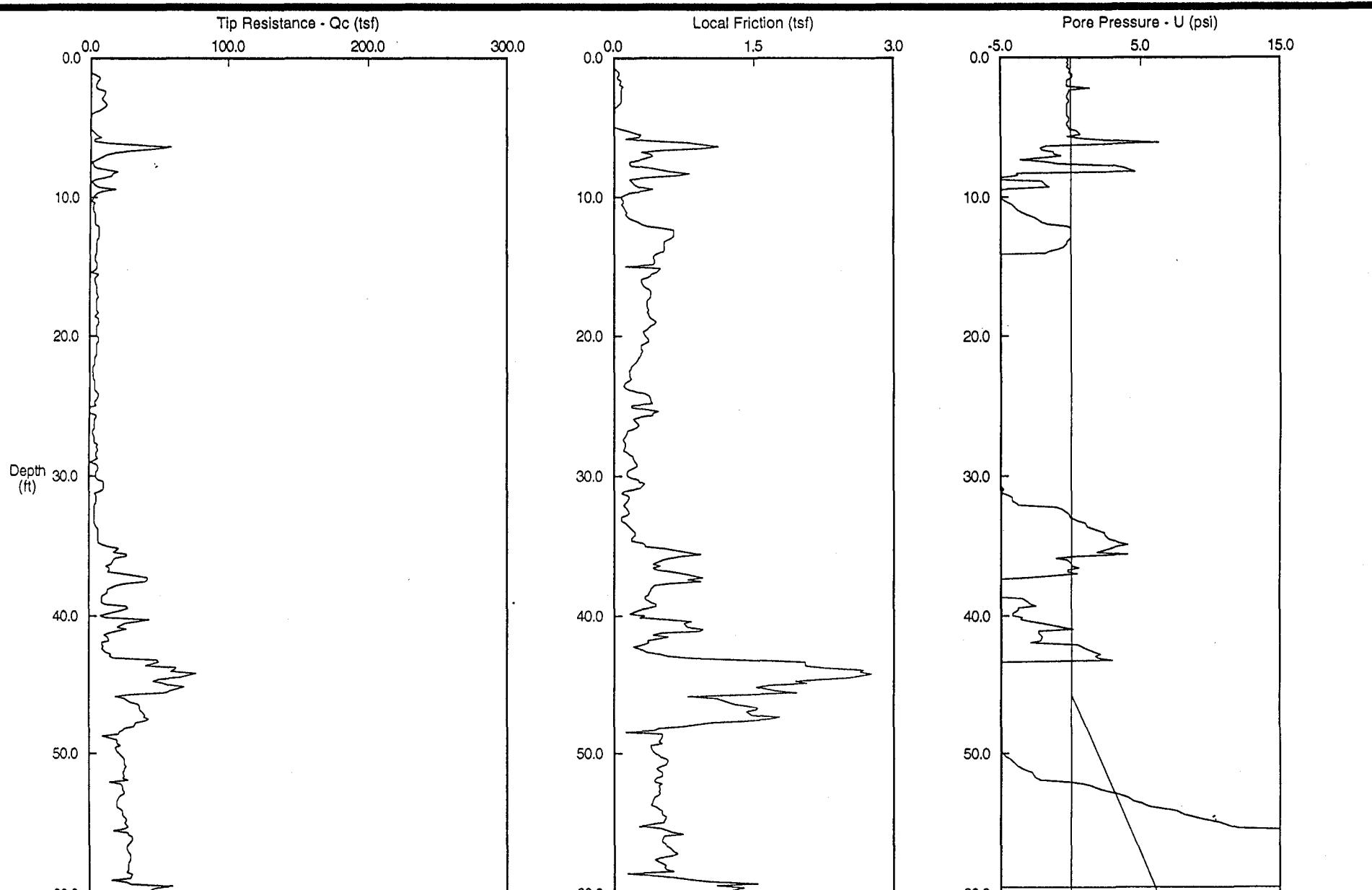


PLOT OF CPT-7  
Steelcote

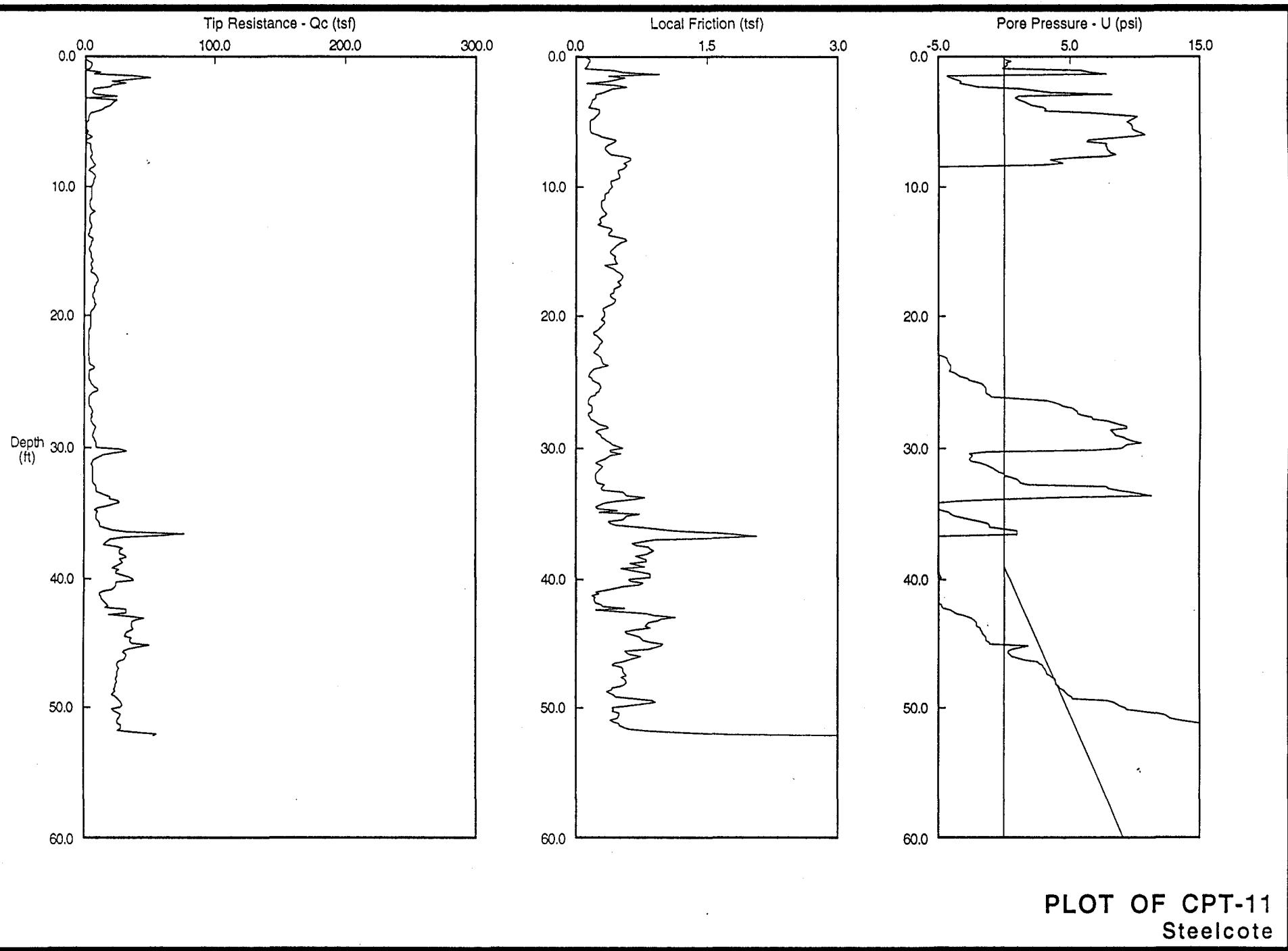


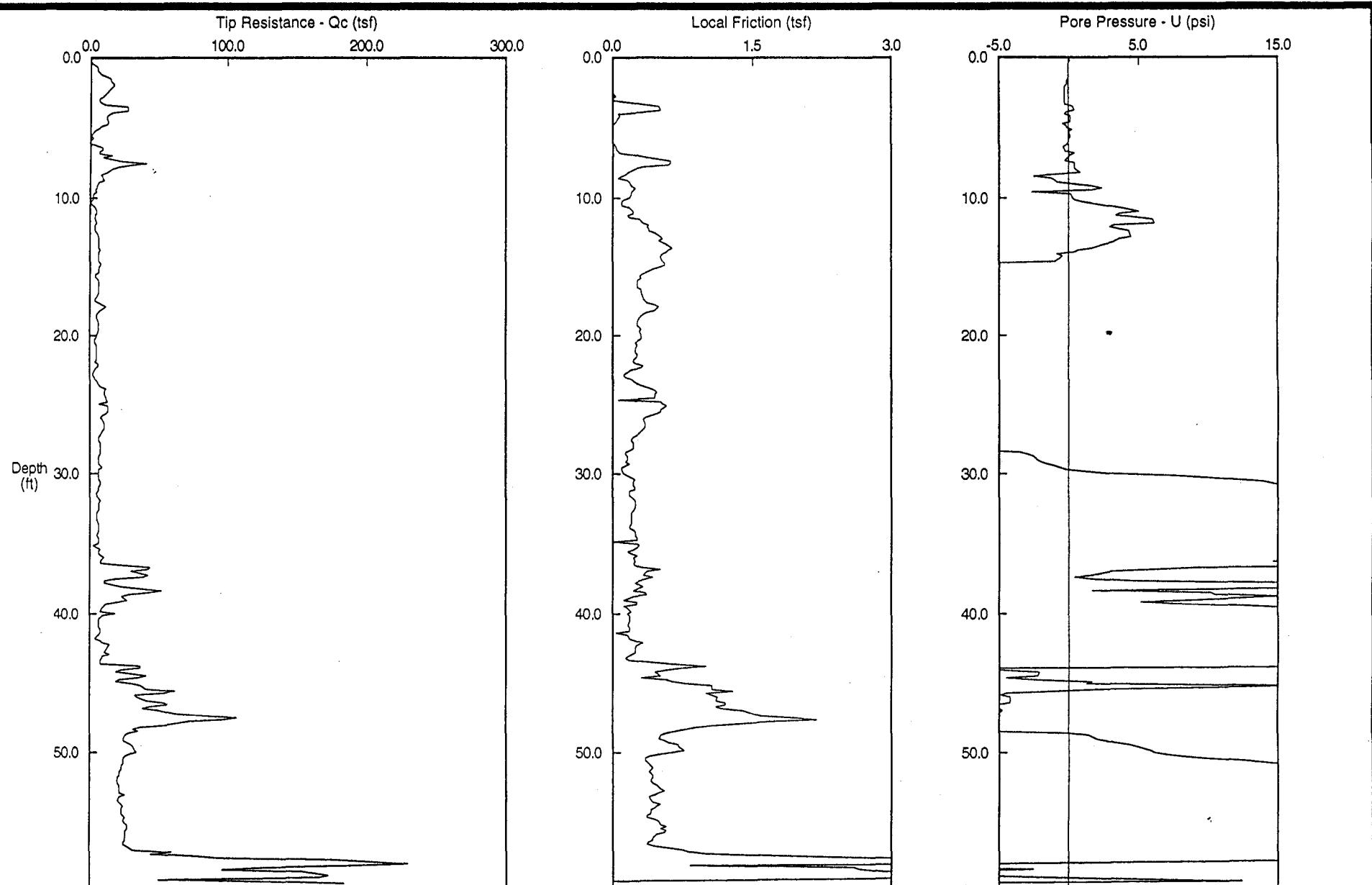


PLOT OF CPT-9  
Steelcote

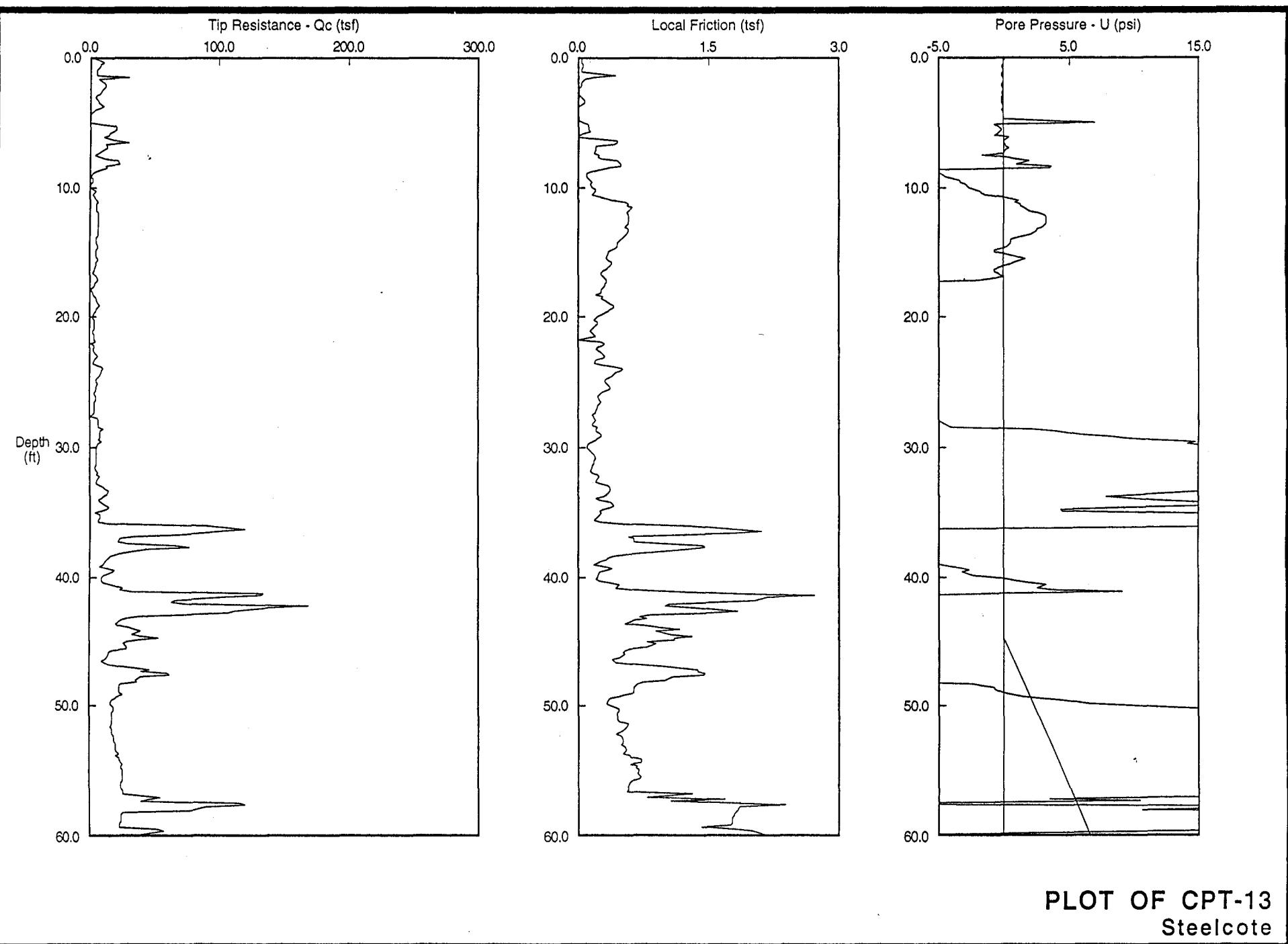


PLOT OF CPT-10  
Steelcote





PLOT OF CPT-12  
Steelcote



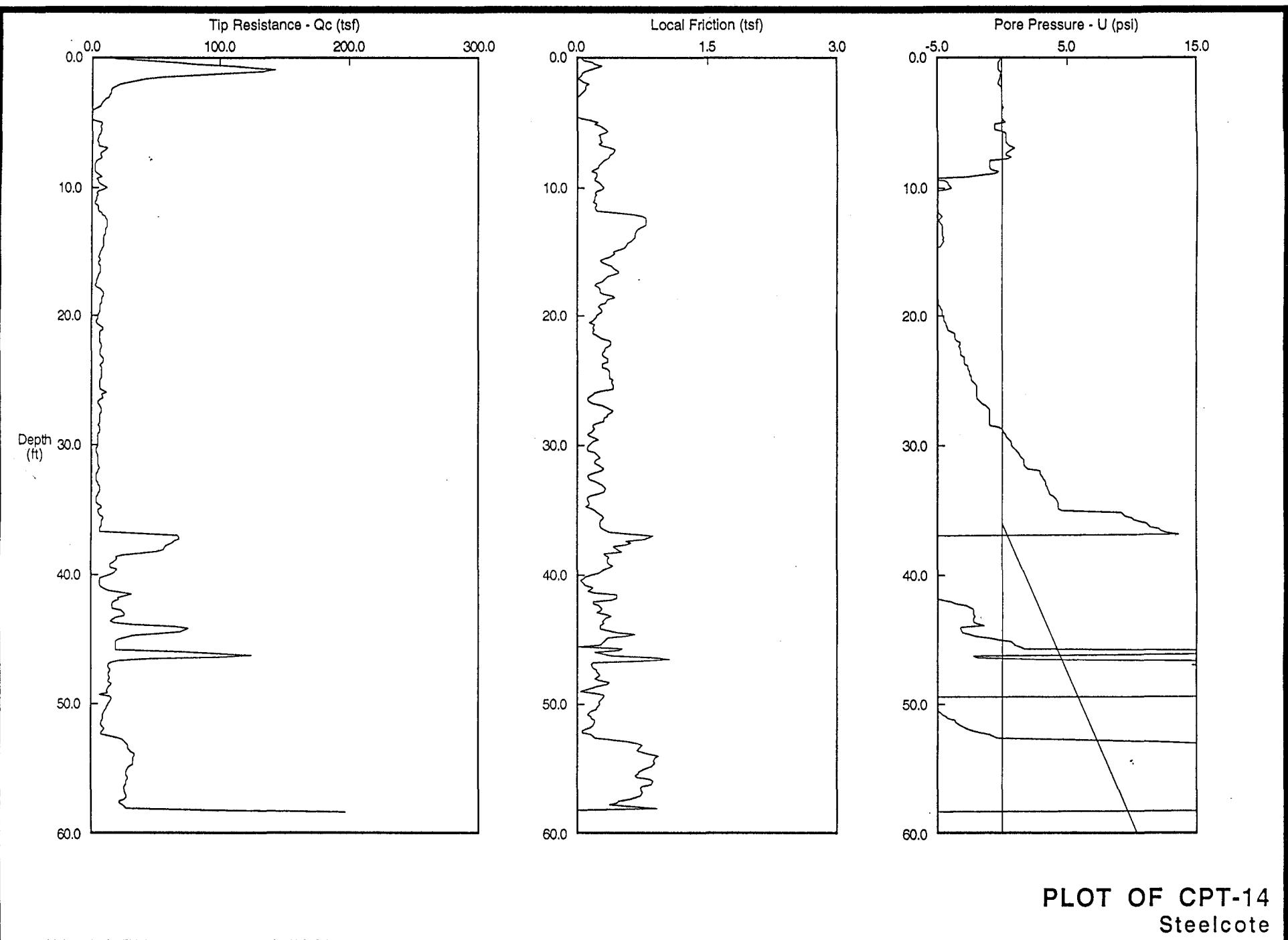
PLOT OF CPT-13  
Steelcote



SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIGURE B-13



**APPENDIX C**

**REVERSE SLUG TEST DATA**

Reverse Slug Test Data  
Steelcote Facility

Well SWGW/1(A)		Well SWGW/1(B)		Well SWGW/1(C)		Well SWGW/1(D)		
Time (min)	Depth (ft)							
0.083	8.05	0.083	8.85	0.083	12.2	0.083	7.95	
0.167	8.15	0.333	9.2	0.167	12.51	0.167	8.05	
0.25	8.3	0.417	9.45	0.333	12.75	0.25	8.15	
0.333	8.45	0.5	9.6	0.5	13	0.333	8.25	
0.417	8.5	0.583	9.7	0.667	13.3	0.417	8.3	
0.5	8.6	0.667	9.9	0.833	13.4	0.5	8.4	
0.583	8.7	0.75	10	1	14.42	0.583	8.45	
0.667	8.8	0.833	10.1	1.333	15.33	0.667	8.55	
0.75	8.9	0.917	10.2	1.5	15.6	0.75	8.6	
0.833	8.95	1	10.35	1.75	16	0.833	8.7	
0.917	9.05	1.083	10.45	2	16.6	0.917	8.75	
1	9.15	1.167	10.5	2.25	17.95	1	8.8	
1.083	9.2	1.25	10.6	2.5	18.23	1.083	8.9	
1.167	9.3	1.333	10.65	2.75	19.4	1.167	8.95	
1.25	9.35	1.417	10.7	3	19.6	1.25	9	
1.333	9.4	1.583	10.8	3.25	20.1	1.333	9.05	
1.417	9.5	1.667	11	3.5	20.6	1.417	9.2	
1.5	9.55	1.833	11.2	3.75	21	1.5	9.25	
1.583	9.6	2	11.4	4	21.35	1.583	9.3	
1.667	9.65	2.083	11.6	4.25	21.45	1.667	9.4	
1.75	9.7	2.5	11.5	4.5	23.4	1.75	9.45	
1.833	9.8	3	11.3	4.75	23.65	1.833	9.5	
1.917	9.85	3.167	11.45	5	24.51	2	9.55	
2	9.9	3.333	11.5	5.25	24.95	2.167	9.6	
2.167	10	3.5	11.6	5.5	25.25	2.333	9.7	
2.333	10.1	3.667	11.7	5.75	25.65	2.5	9.8	
2.5	10.2	3.833	11.8	6	25.9	2.667	9.9	
2.667	10.3	4	11.85	6.25	26.85	2.833	9.95	
2.833	10.4	4.167	11.9	6.5	27.3	3	10	
3	10.5	4.333	12	6.75	27.6	3.167	10.1	
3.167	10.55	4.5	12.05	7	27.8	3.333	10.15	
3.333	10.65	4.667	12.15	7.25	28.1	3.5	10.25	
3.5	10.7	4.833	12.2	7.5	28.4	3.667	10.3	
3.667	10.8	5	12.25	7.75	29.1	3.833	10.4	
3.833	10.85	5.167	12.3	8	29.35	4	10.45	
4	10.95	5.333	12.4	8.25	29.7	4.167	10.5	
4.25	11	5.5	12.45	8.5	30.15	4.333	10.6	
4.5	11.1	5.667	12.5	8.75	30.5	4.5	10.65	
4.75	11.2	5.833	12.6	9	30.81	4.667	10.7	
5	11.3	6	12.65	9.25	31.15	4.833	10.75	
5.25	11.35	6.167	12.71	9.5	31.4	5	10.8	
5.5	11.42	6.333	12.8	9.75	31.6	5.167	10.85	
5.75	11.5	6.5	12.85	10	31.9	5.333	10.9	
6	11.56	6.667	12.9	10.25	32.25	5.5	10.95	
6.5	11.7	6.833	13	10.5	32.45	5.667	11	
7	11.8	7	13.1	10.75	32.7	5.833	11.05	
7.5	11.9	7.25	13.2	11	32.95	6	11.1	

Reverse Slug Test Data  
Steelcote Facility

Well SWGW/1(A)		Well SWGW/1(B)		Well SWGW/1(C)		Well SWGW/1(D)		
Time (min)	Depth (ft)							
8	12	7.5	13.3	11.25	33.2	6.25	11.15	
8.5	12.08	7.75	13.4	11.5	33.4	6.5	11.25	
9	12.15	8	13.5	11.75	33.6	6.75	11.35	
9.5	12.21	8.25	13.6	12	33.8	7	11.4	
10	12.28	8.5	13.7	12.25	34	7.25	11.5	
11	12.39	8.75	13.8	12.5	34.35	7.5	11.55	
12	12.48	9	13.95	12.75	34.44	7.75	11.6	
15	12.67	9.5	14.15	13	34.55	8	11.65	
20	12.87	9.75	14.25	13.25	34.68	8.25	11.7	
25	13	10	14.35	13.5	34.78	8.5	11.8	
30	13.04	10.25	14.45	13.75	34.85	8.75	11.85	
		10.5	14.55	14	34.95	9	11.88	
		10.75	14.65	14.25	35.02	9.25	11.9	
		11	14.75	14.5	35.2	9.5	11.93	
		11.25	14.85	14.75	35.4	10	12.05	
		11.5	14.95	15	35.45	10.5	12.15	
		11.75	15	15.5	35.55	11	12.2	
		12	15.1	16	35.65	11.5	12.26	
		12.5	15.3	16.5	35.8	12	12.35	
		13	15.45	17	35.93	13	12.36	
		13.5	15.6	17.5	36.03	14	12.39	
		14	15.8	18	36.23	15	12.41	
		14.5	15.95	18.5	36.4	16	12.44	
		15	16.1	19	36.5	17	12.46	
		16	16.45	19.5	36.63	20	12.52	
		17	16.75	20	36.75	25	12.62	
		18	17	21	37	30	12.7	
		19	17.3	22	37.22	35	12.8	
		20	17.6	23	37.43			
		21	17.95	24	37.62			
		22	18.25	25	37.78			
		23	18.5	27	37.95			
		24	18.85	29	38.02			
		25	19.15	31	38.15			
		26	19.5	35	38.27			
		27	19.75	40	38.33			
		28	20	45	38.4			
		29	20.3					
		30	20.5					
		35	21.75					
		40	22.65					
		45	24					
		51.25	25.4					
		55	26.15					
		60	27.2					
		65	28.1					
		70	28.75					

Reverse Slug Test Data  
Steelcote Facility

Time (min)	A h/h0	Time (min)	B h/h0	Time (min)	C h/h0	Time (min)	D h/h0	
0.083	1	0.083	1	0.083	1	0.083	1	
0.167	0.9818182	0.333	0.9870849	0.167	0.9887722	0.167	0.9805825	
0.25	0.9545455	0.417	0.9778598	0.333	0.9800797	0.25	0.961165	
0.333	0.9272727	0.5	0.9723247	0.5	0.971025	0.333	0.9417476	
0.417	0.9181818	0.583	0.9686347	0.667	0.9601594	0.417	0.9320388	
0.5	0.9	0.667	0.9612546	0.833	0.9565375	0.5	0.9126214	
0.583	0.8818182	0.75	0.9575646	1	0.9195943	0.583	0.9029126	
0.667	0.8636364	0.833	0.9538745	1.333	0.8866353	0.667	0.8834951	
0.75	0.8454545	0.917	0.9501845	1.5	0.8768562	0.75	0.8737864	
0.833	0.8363636	1	0.9446494	1.75	0.8623687	0.833	0.8543689	
0.917	0.8181818	1.083	0.9409594	2	0.8406375	0.917	0.8446602	
1	0.8	1.167	0.9391144	2.25	0.7917421	1	0.8349515	
1.083	0.7909091	1.25	0.9354244	2.5	0.7816009	1.083	0.815534	
1.167	0.7727273	1.333	0.9335793	2.75	0.7392249	1.167	0.8058252	
1.25	0.7636364	1.417	0.9317343	3	0.7319812	1.25	0.7961165	
1.333	0.7545455	1.583	0.9280443	3.25	0.7138718	1.333	0.7864078	
1.417	0.7363636	1.667	0.9206642	3.5	0.6957624	1.417	0.7572816	
1.5	0.7272727	1.833	0.9132841	3.75	0.6812749	1.5	0.7475728	
1.583	0.7181818	2	0.9059041	4	0.6685983	1.583	0.7378641	
1.667	0.7090909	2.083	0.898524	4.25	0.6649765	1.667	0.7184466	
1.75	0.7	2.5	0.902214	4.5	0.5943499	1.75	0.7087379	
1.833	0.6818182	3	0.9095941	4.75	0.5852952	1.833	0.6990291	
1.917	0.6727273	3.167	0.904059	5	0.554147	2	0.6893204	
2	0.6636364	3.333	0.902214	5.25	0.5382108	2.167	0.6796117	
2.167	0.6454545	3.5	0.898524	5.5	0.5273452	2.333	0.6601942	
2.333	0.6272727	3.667	0.8948339	5.75	0.5128577	2.5	0.6407767	
2.5	0.6090909	3.833	0.8911439	6	0.503803	2.667	0.6213592	
2.667	0.5909091	4	0.8892989	6.25	0.4693951	2.833	0.6116505	
2.833	0.5727273	4.167	0.8874539	6.5	0.4530967	3	0.6019417	
3	0.5545455	4.333	0.8837638	6.75	0.4422311	3.167	0.5825243	
3.167	0.5454545	4.5	0.8819188	7	0.4349873	3.333	0.5728155	
3.333	0.5272727	4.667	0.8782288	7.25	0.4241217	3.5	0.5533981	
3.5	0.5181818	4.833	0.8763838	7.5	0.4132561	3.667	0.5436893	
3.667	0.5	5	0.8745387	7.75	0.3879029	3.833	0.5242718	
3.833	0.4909091	5.167	0.8726937	8	0.3788482	4	0.5145631	
4	0.4727273	5.333	0.8690037	8.25	0.3661717	4.167	0.5048544	
4.25	0.4636364	5.5	0.8671587	8.5	0.3498732	4.333	0.4854369	
4.5	0.4454545	5.667	0.8653137	8.75	0.3371967	4.5	0.4757282	
4.75	0.4272727	5.833	0.8616236	9	0.3259689	4.667	0.4660194	
5	0.4090909	6	0.8597786	9.25	0.3136545	4.833	0.4563107	
5.25	0.4	6.167	0.8575646	9.5	0.3045998	5	0.4466019	
5.5	0.3872727	6.333	0.8542435	9.75	0.297356	5.167	0.4368932	
5.75	0.3727273	6.5	0.8523985	10	0.2864904	5.333	0.4271845	
6	0.3618182	6.667	0.8505535	10.25	0.2738138	5.5	0.4174757	
6.5	0.3363636	6.833	0.8468635	10.5	0.2665701	5.667	0.407767	
7	0.3181818	7	0.8431734	10.75	0.2575154	5.833	0.3980583	
7.5	0.3	7.25	0.8394834	11	0.2484607	6	0.3883495	
8	0.2818182	7.5	0.8357934	11.25	0.239406	6.25	0.3786408	

Reverse Slug Test Data  
Steelcote Facility

Time (min)	A h/h0	Time (min)	B h/h0	Time (min)	C h/h0	Time (min)	D h/h0	
8.5	0.2672727	7.75	0.8321033	11.5	0.2321623	6.5	0.3592233	
9	0.2545455	8	0.8284133	11.75	0.2249185	6.75	0.3398058	
9.5	0.2436364	8.25	0.8247232	12	0.2176748	7	0.3300971	
10	0.2309091	8.5	0.8210332	12.25	0.210431	7.25	0.3106796	
11	0.2109091	8.75	0.8173432	12.5	0.1977544	7.5	0.3009709	
12	0.1945455	9	0.8118081	12.75	0.1944947	7.75	0.2912621	
15	0.16	9.5	0.804428	13	0.1905107	8	0.2815534	
20	0.1236364	9.75	0.800738	13.25	0.1858022	8.25	0.2718447	
25	0.1	10	0.797048	13.5	0.1821804	8.5	0.2524272	
30	0.0927273	10.25	0.7933579	13.75	0.1796451	8.75	0.2427184	
		10.5	0.7896679	14	0.1760232	9	0.2368932	
		10.75	0.7859779	14.25	0.1734879	9.25	0.2330097	
		11	0.7822878	14.5	0.1669685	9.5	0.2271845	
		11.25	0.7785978	14.75	0.1597247	10	0.2038835	
		11.5	0.7749077	15	0.1579138	10.5	0.184466	
		11.75	0.7730627	15.5	0.1542919	11	0.1747573	
		12	0.7693727	16	0.15067	11.5	0.1631068	
		12.5	0.7619926	16.5	0.1452372	12	0.1456311	
		13	0.7564576	17	0.1405288	13	0.1436893	
		13.5	0.7509225	17.5	0.1369069	14	0.1378641	
		14	0.7435424	18	0.1296632	15	0.1339806	
		14.5	0.7380074	18.5	0.123506	16	0.1281553	
		15	0.7324723	19	0.1198841	17	0.1242718	
		16	0.7195572	19.5	0.1151757	20	0.1126214	
		17	0.7084871	20	0.1108294	25	0.0932039	
		18	0.699262	21	0.1017747	30	0.0776699	
		19	0.6881919	22	0.0938066	35	0.0582524	
		20	0.6771218	23	0.0862007			
		21	0.6642066	24	0.0793191			
		22	0.6531365	25	0.0735241			
		23	0.6439114	27	0.0673669			
		24	0.6309963	29	0.0648316			
		25	0.6199262	31	0.0601231			
		26	0.6070111	35	0.0557769			
		27	0.597786	40	0.0536038			
		28	0.5885609	45	0.0510685			
		29	0.5774908					
		30	0.5701107					
		35	0.5239852					
		40	0.4907749					
		45	0.4409594					
		51.25	0.3892989					
		55	0.3616236					
		60	0.3228782					
		65	0.2896679					
		70	0.2656827					

Reverse Slug Test  
Well SWGW/1(A)

Depth (ft) vs. Time (min)

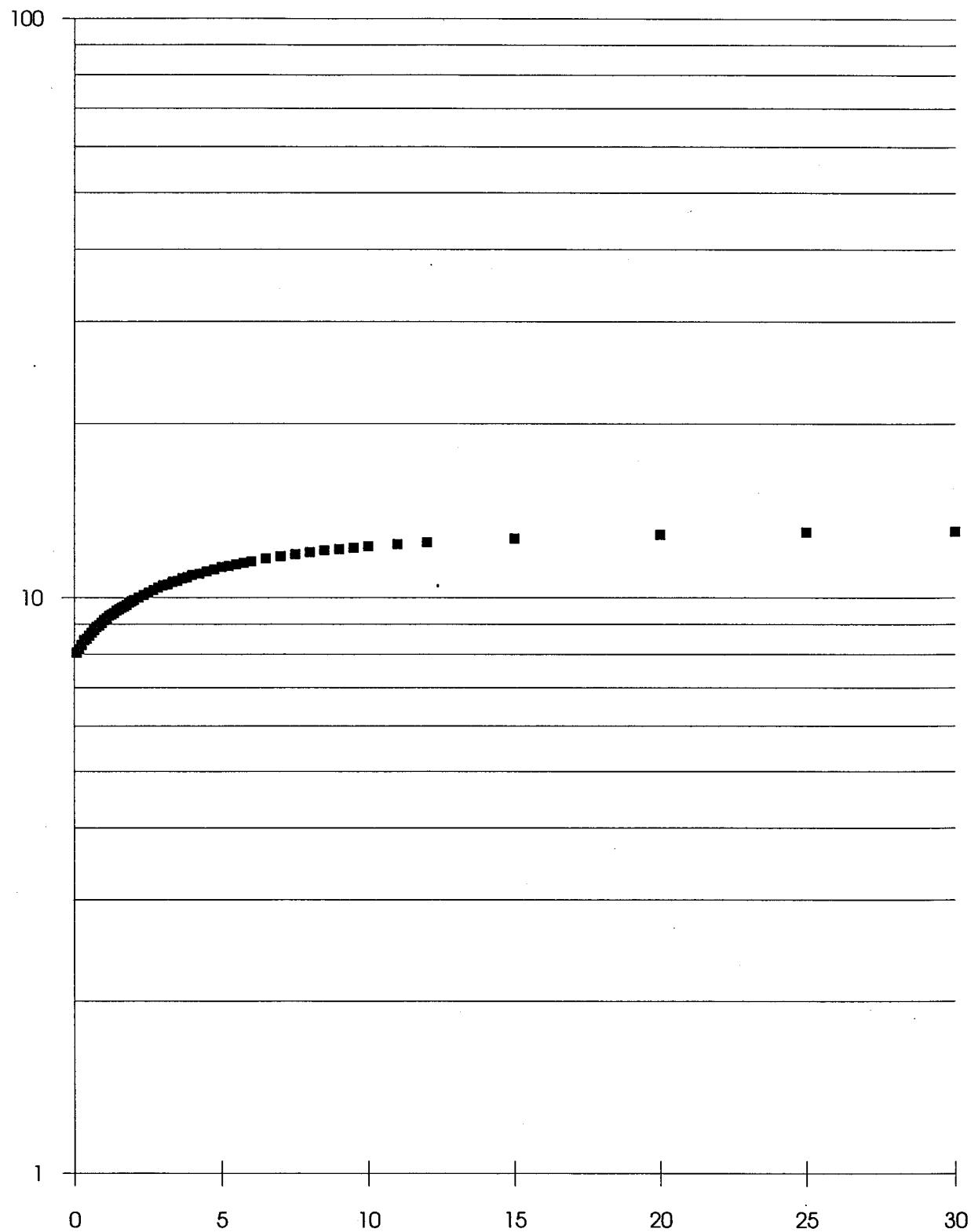


FIGURE C-1

Reverse Slug Test  
Well SWGW/1(B)

Depth (ft) vs. Time (min)

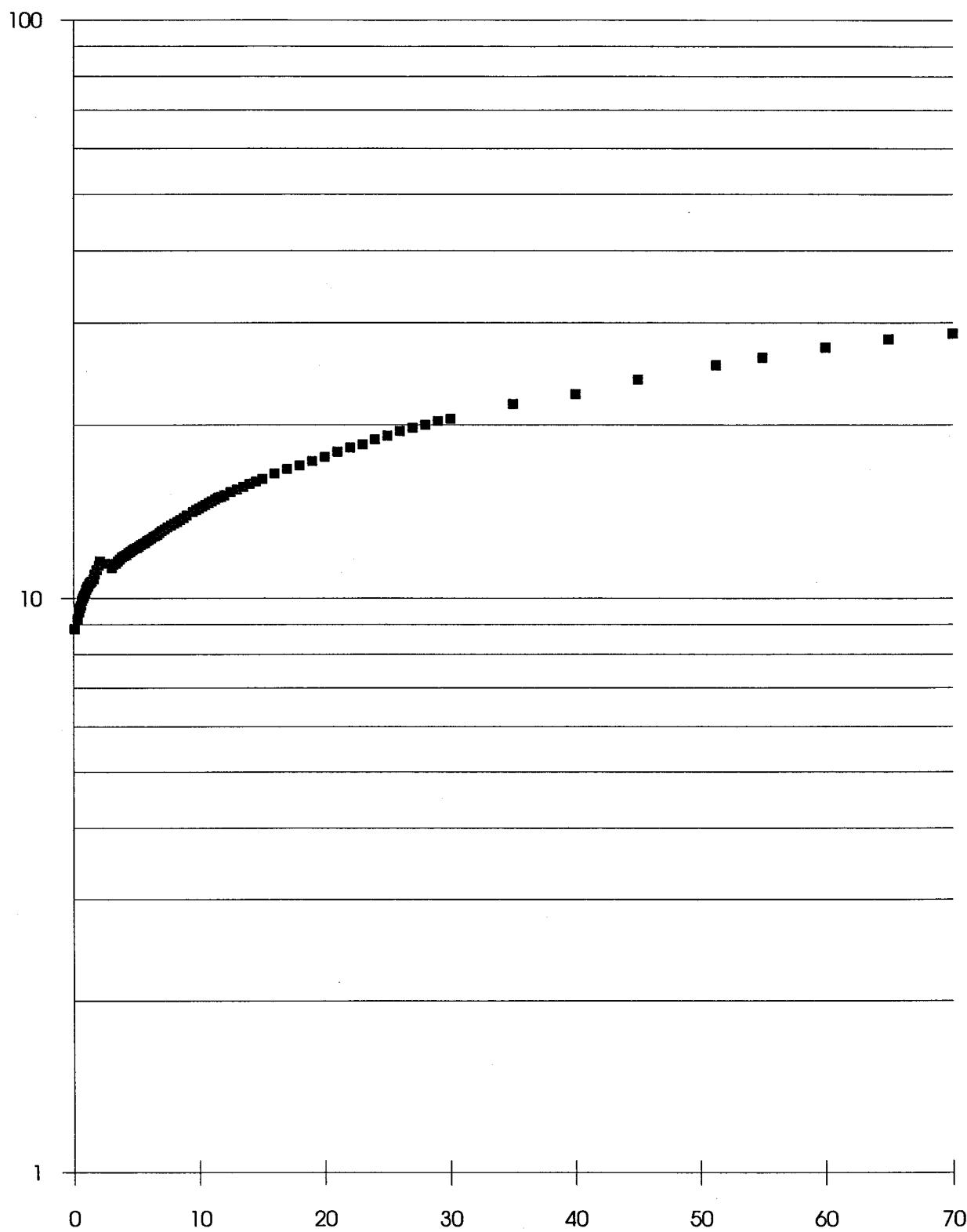


FIGURE C-2

Reverse Slug Test  
Well SWGW/1(C)

Depth (ft) vs. Time (min)

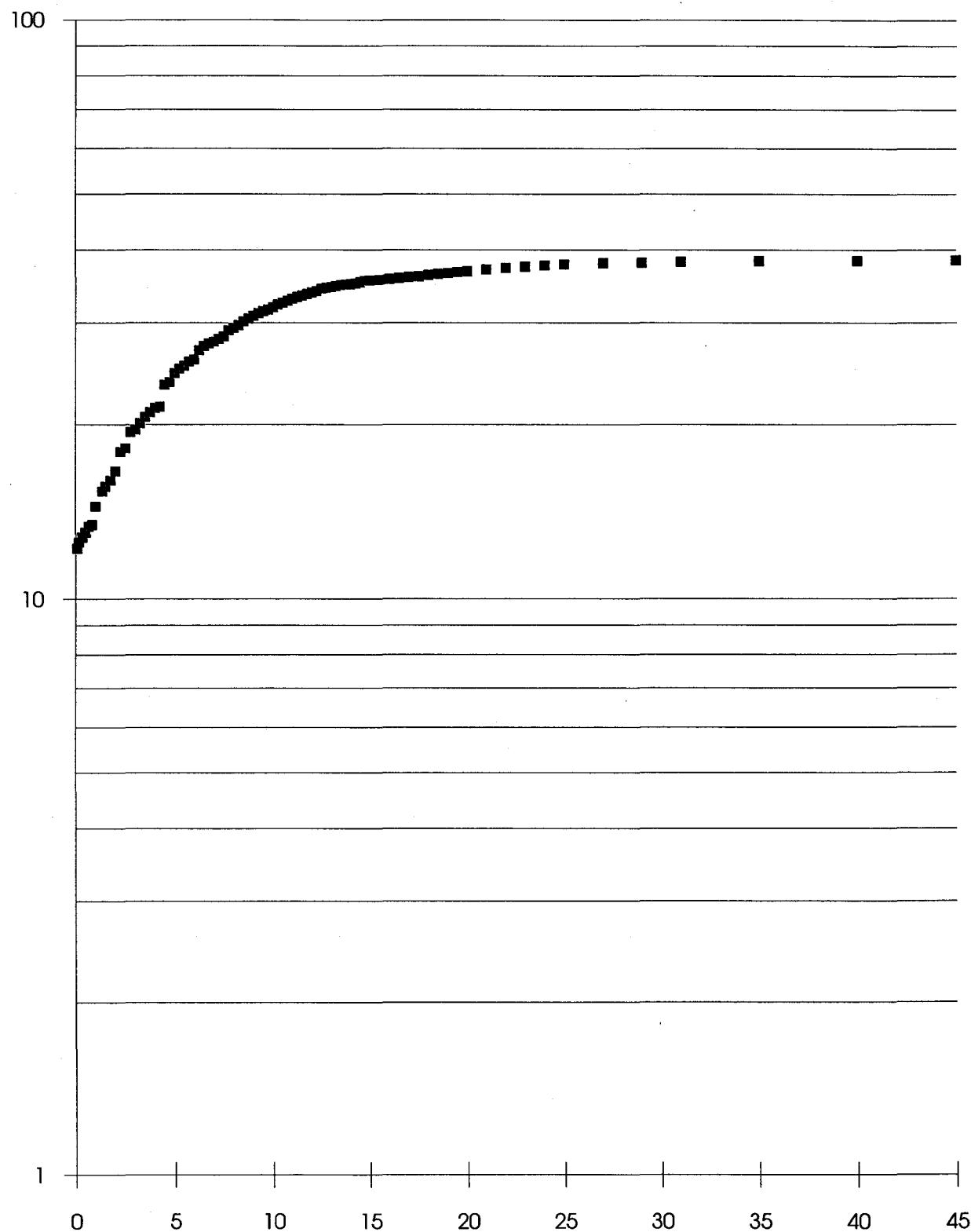


FIGURE C-3

Reverse Slug Test  
Well SWGW/1(D)

Depth (ft) vs. Time (min)

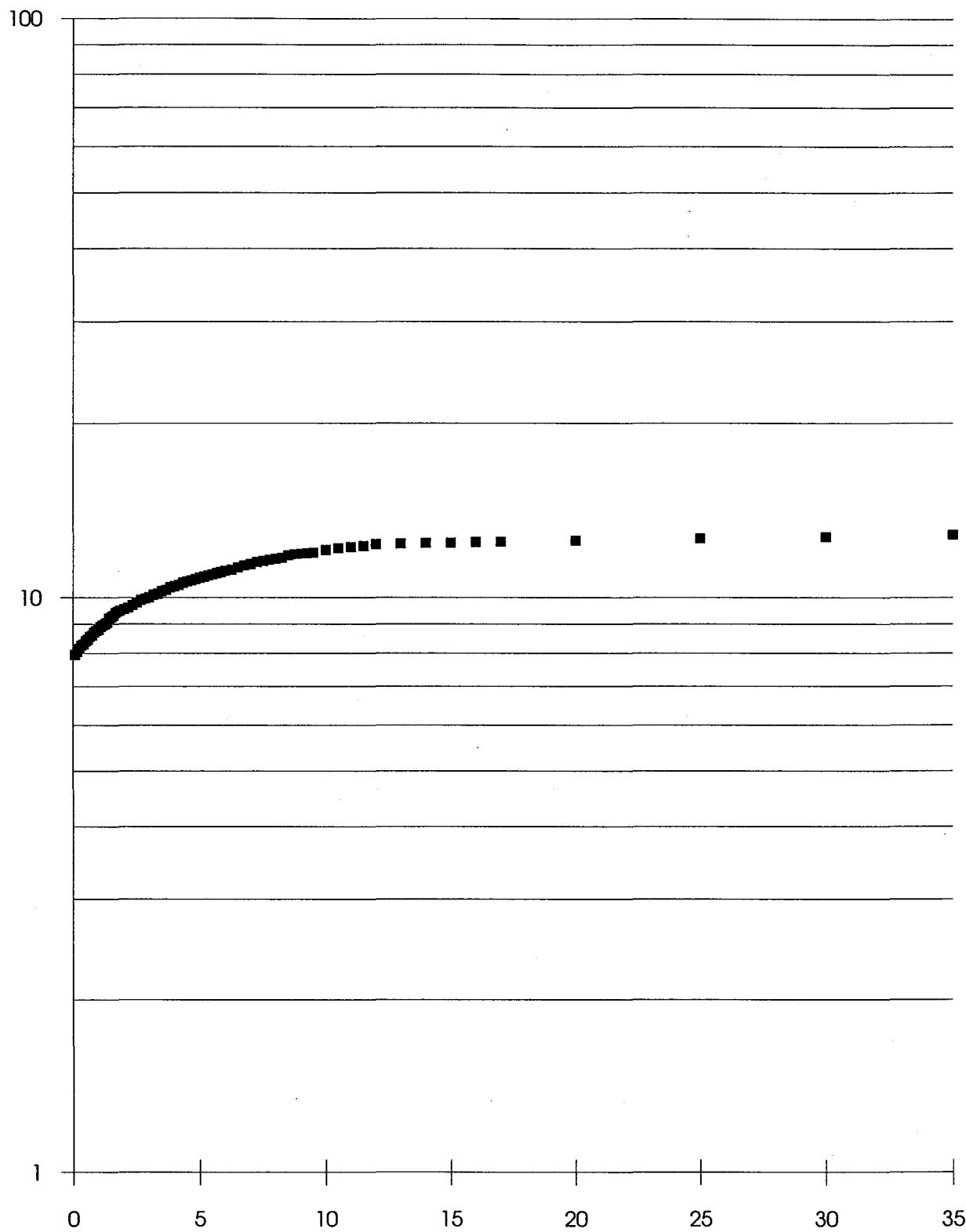


FIGURE C-4

Reverse Slug Test  
Well SWGW/1(A)

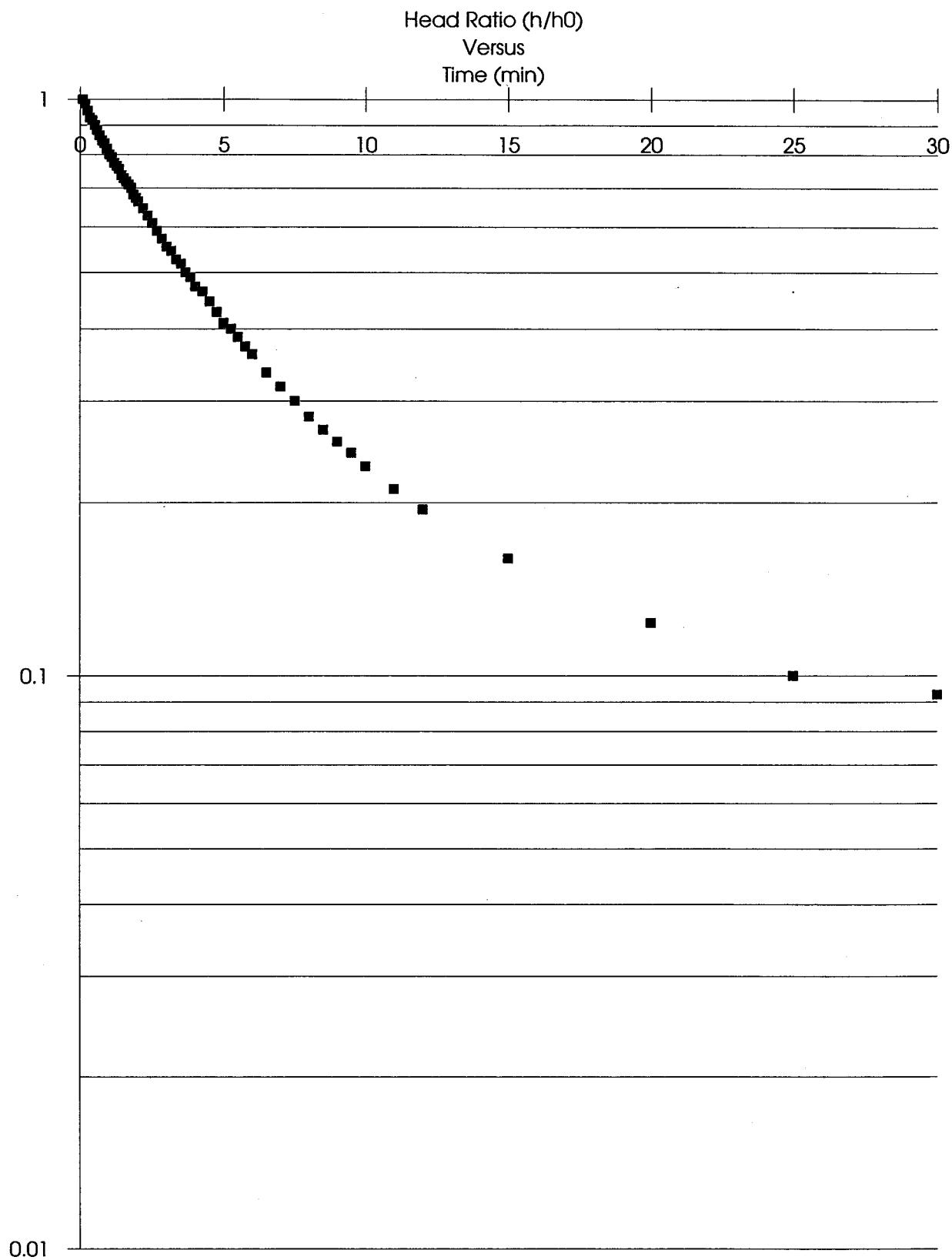


FIGURE C-5

Reverse Slug Test  
Well SWGW/1(B)

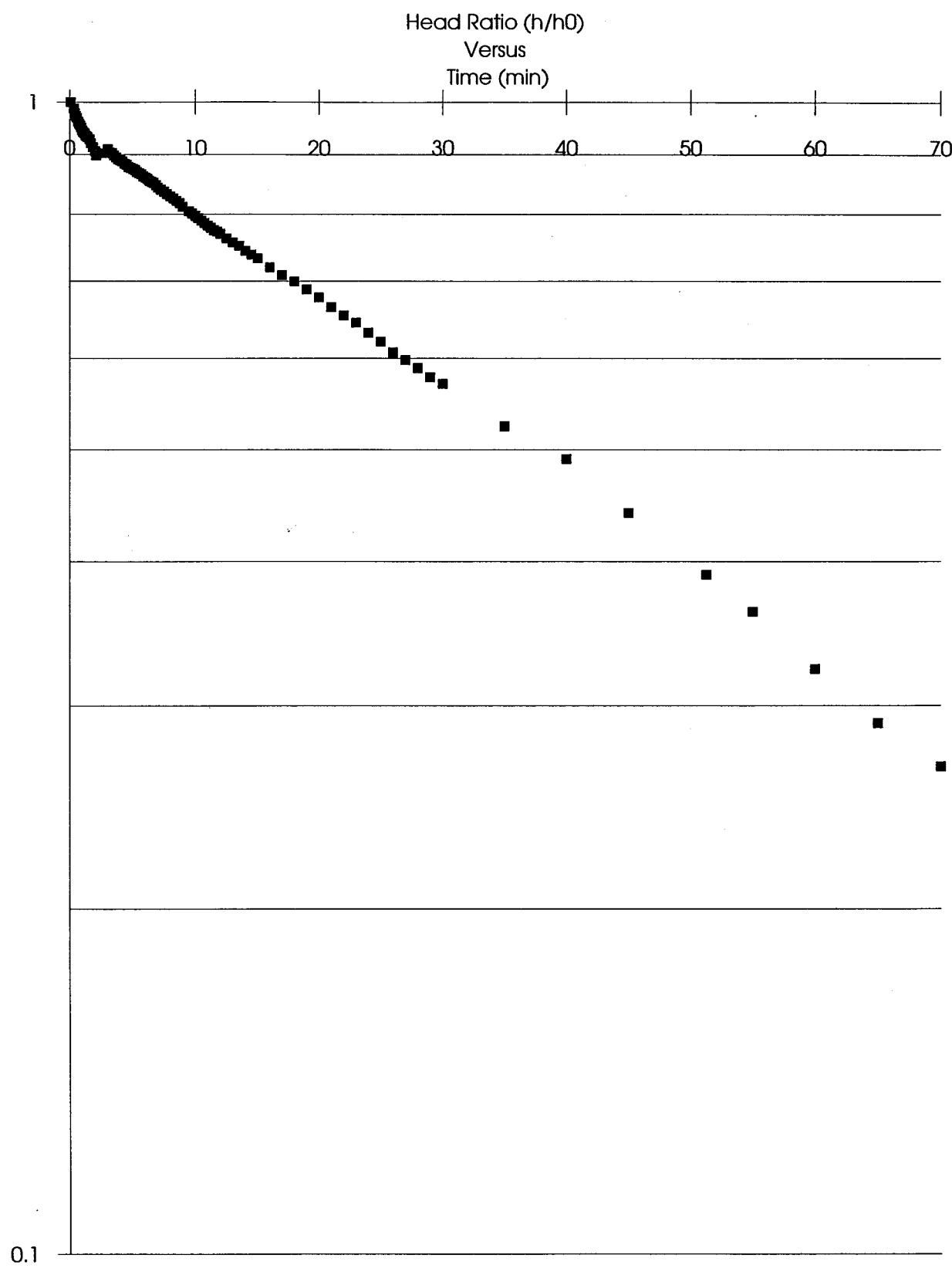


FIGURE C-6

Reverse Slug Test  
Well SWGW/1(C)

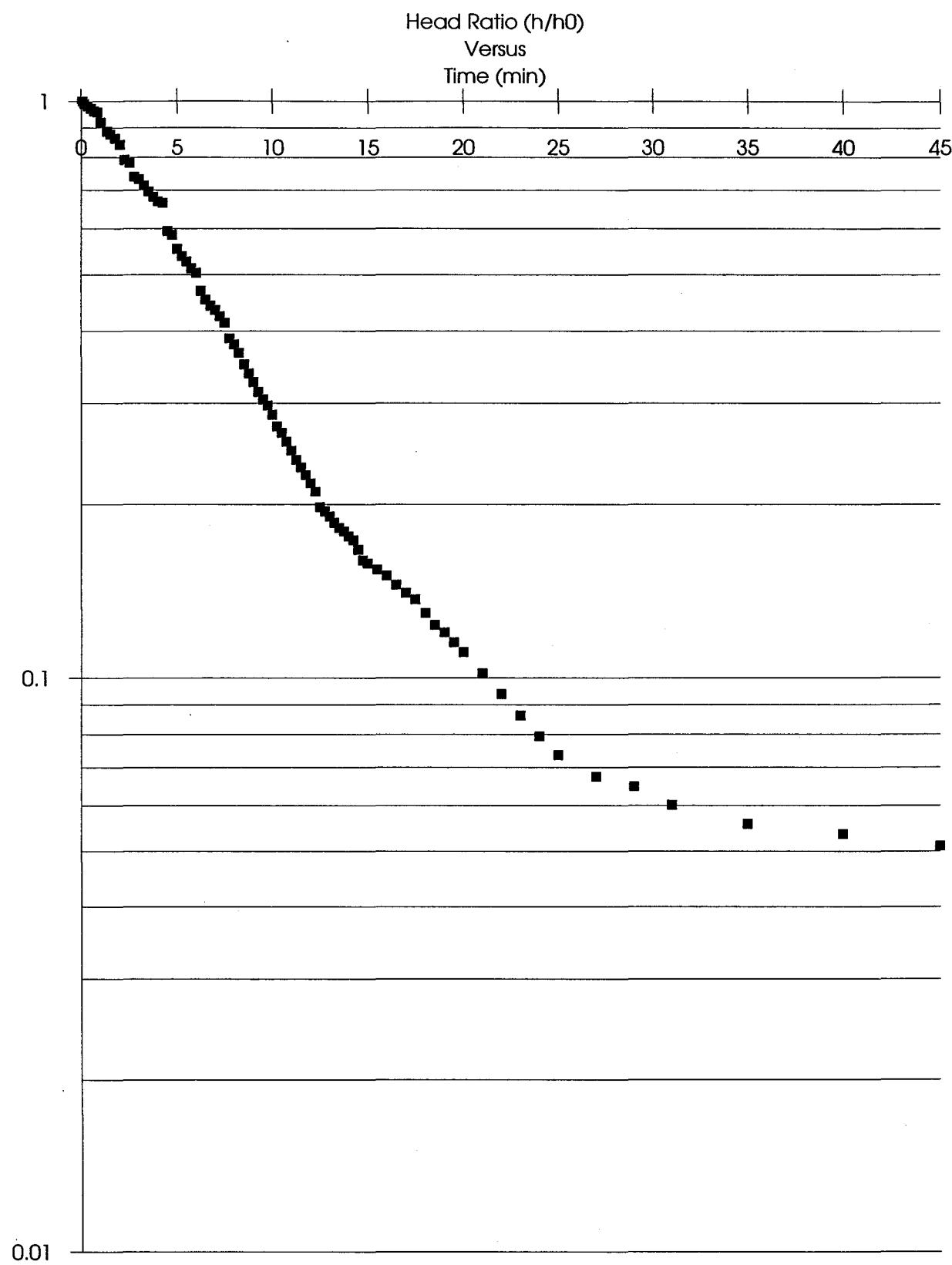


FIGURE C-7

Reverse Slug Test  
Well SWGW/1(D)

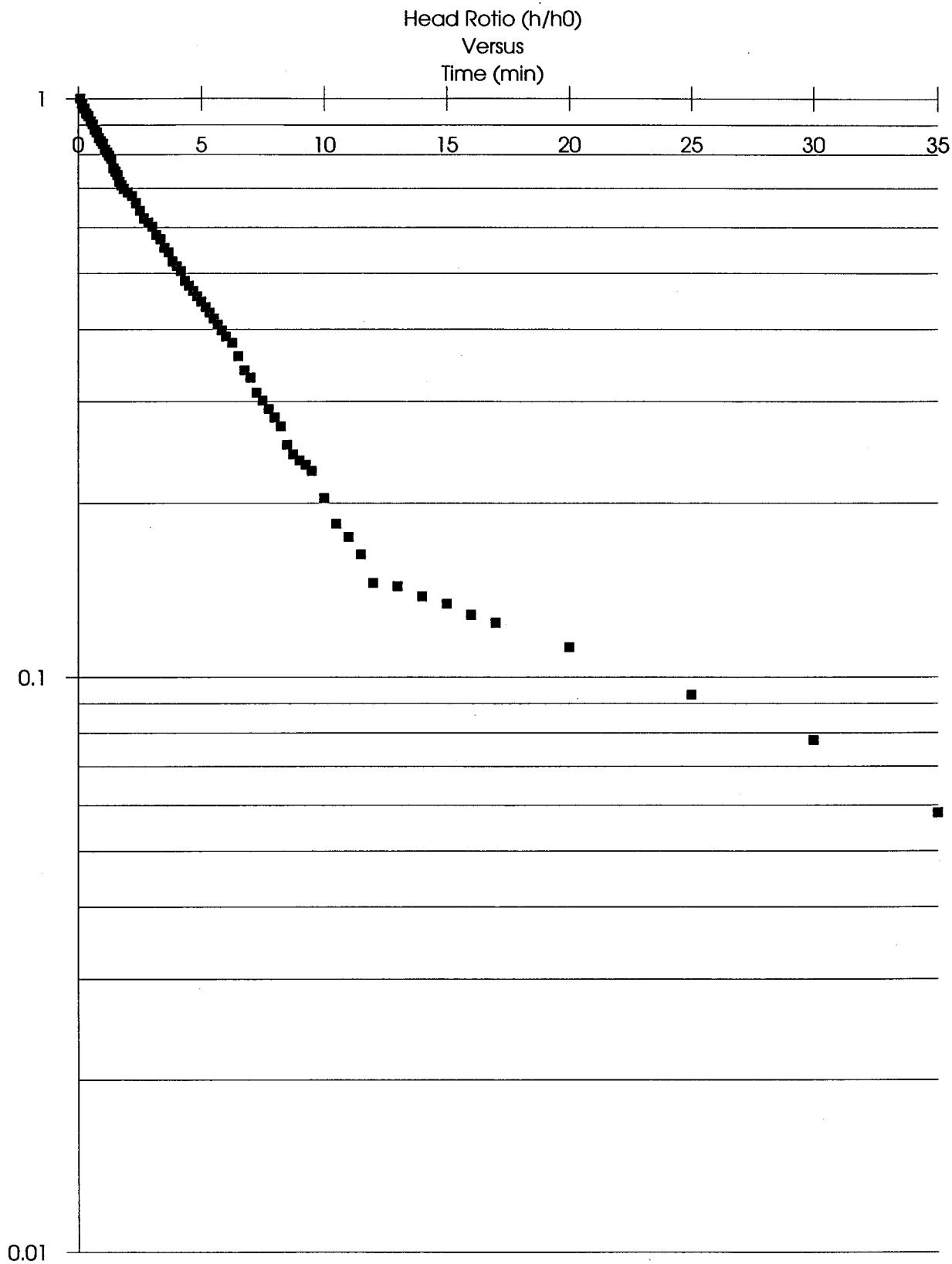


FIGURE C-8